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THE FOUNDRY

THE PENTON PUBLISHING CO.
Cleveland New York Chicago Pittsburg.

ESTABLISHED 1874

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Cincinnati Chicago Pittsburg

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P. S.—Such samples do not come back to us.

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THE FOUNDRY

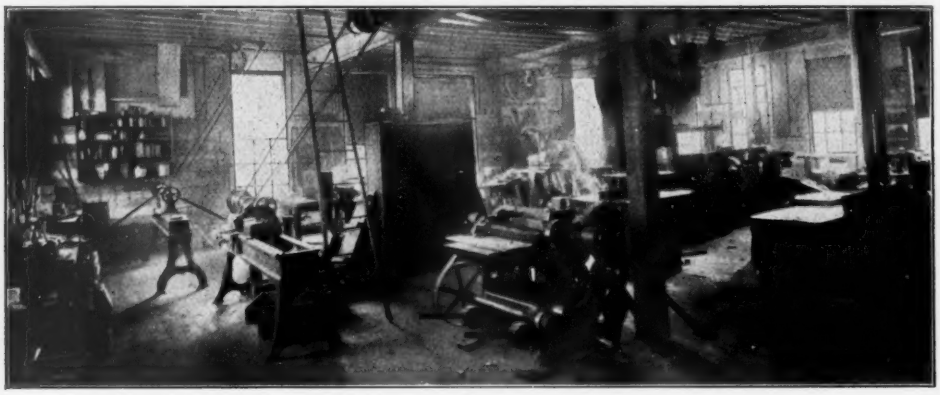
Vol. 27, No. 4. *CLEVELAND, OHIO, DECEMBER 1905.* *Whole No. 160*

Foundry of the Leland & Faulconer Mfg. Co., Detroit, Mich.

The name of this company has always stood for the best possible product in any line which it manufactured. The Leland-Faulconer grinders have long been known among shop owners as high grade tools. As new fields for better work opened up the company has always been ready to step into them, and hence it was but natural that when the automobile work came forward with its exceedingly exacting conditions, that this company should decide that the automobile work was just the kind of trouble it was looking for. At first it simply made castings for automobile manufacturers; later the machine shop was fitted up especially for the making of the engines for the Cadillac Automobile Co., and at present these engines are made and tested in the Leland-Faulconer Co.'s works. The transmission gear for the Cadillac Automobile Co. is also made by the Leland-Faulconer Co. In addition to this there is a very large variety of other casting work done in the foundry. When it was decided to go out of the heavy casting business and specialize all light work, some of the old customers simply refused to go elsewhere for their castings, as quality and accuracy were important to them, and for this reason the company still does some fairly heavy work. The majority of the output, however, is automobile stuff which is put up either on the floor or by bench molders. None of the castings made exceed two tons in weight, and the majority of them are less than 50 pounds. In addition to this automobile work a large number of castings are made for steam traps and water columns.

GENERAL VIEW OF FOUNDRY.

The foundry building proper is 272 ft. x 80 ft., and is constructed with walls of sufficient height to give ample light. The side



PATTERN SHOP.

walls above the level of the benches are all constructed of glass. A series of ventilators are placed in the roof for carrying off smoke and steam. The plant is heated and ventilated by the Buffalo Forge Co.'s heating and ventilating system. For handling the heavier work a steam hydraulic jib crane is installed near the cupola. The majority of the iron, however, is carried away in hand or bull ladles.

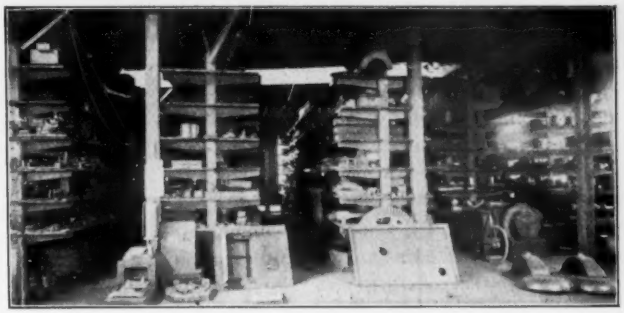
The cupola is 54 in. in diameter inside of the lining, and is provided with two tap holes, one so situated that a large ladle can be swung under it from the crane. The other tap hole is used entirely for hand ladle work, and in many cases iron is drawn from both tap holes into hand or bull ladles. This enables them to take off a heat very quickly, and hence the molders are not delayed by waiting for iron. A night gang is employed to clean up the foundry and cut up the sand so that when the men come in the morning they begin molding at once. As during the night the electric light plant belonging to the company is not in operation, the foundry is then lighted by gasoline torches which are attached to wooden poles provided with hooks at the upper end so that they may be hooked over the cords of the roof trusses.

At the end of the foundry next to the cupola is located the storage shed. On the lower level—that is, on the floor corresponding to the main foundry floor are placed bins for molding sand, fireclay, seacoal, coke, etc. The material is shoveled into these bins from cars on the railroad track. Over the bins there is located a storage for pig iron, which is capable of holding several weeks' supply. The iron is put into the storage by passing it from the cars to a platform and from the platform to the storage floor. As the storage floor is so situated that the iron can be trucked from it right onto the cupola charging platform, and as double handling would be necessary in taking care of the different grades of iron, this method is not as wasteful in energy as might first appear, but has worked out very well. During the summer the greater portion of the iron is stored in the yard, and a considerable portion of the coke is also stored here. A steam hydraulic elevator made by the Craig-Ridgway Co. serves to lift the stock from the yard level to the level of the charging platform. The charging platform is of sufficient area to hold all the material for a heat, and the bin storage capacity sufficient to hold a winter's supply of molding sand.

The core department is situated at one end of the foundry and is equipped with the necessary benches for making the different classes of cores. For drying the cores there is a Brown & Sharpe core oven and a large truck oven. The truck oven is also provided with shelves at the sides onto which the plates of the small cores are placed.

The cleaning department is located in a building adjoining the main foundry and it is necessary to divide it into a number of departments to meet the requirements of the different classes of castings produced. The tumbling barrels in the tum-

bling room are of the exhaust type. In the grinding room the grinding wheels are all provided with hoods and an exhaust system removes the dust. There is also a pickling department. In many respects the most interesting part of the cleaning room is the testing department for testing gas engine cylinders. The cores are first removed from these cylinders either by tumbling or by hand cleaning. They are then taken to the testing bench and some of the openings plugged with wood which is wet and allowed to swell to close the openings. The cylinders are then subjected to the desired water test, and if found defective are scrapped at once. If not, they are taken to the tumbling barrels and thoroughly cleaned. In making some special types of automobile cylinders it has been found impracticable



PATTERN STORAGE.

CORE DEPARTMENT.

to get at one or two of the core wires, and where this is the case the wires are made to come to the surface of the core at one point so that they will burn fast to the casting and not rattle around in the jacket.

Next to the cleaning department is located the pattern shop, which is equipped with the latest machinery, including a 30-in. planer, one combination cross-cut and rip saw, one jointer, two modern iron bed lathes, provided with rack longitudinal and screw cross feed, one 36 in. band saw, one gig saw, several trimmers and benches for ten patternmakers. Metal patterns are made in the machine shop. The pattern storage is located above the pattern shop and cleaning department, an elevator being provided for transporting the patterns to and from the storage. Most of the patterns are small and are kept on shelves.

The foundry office is located at one side of the pattern storage, and a foundry clerk is employed whose business it is to look after all the orders from the time they are received until the castings are receipted for by the machine shop or have been delivered to the purchaser when they are made for outside parties. By the system used the superintendent can tell at a glance just the condition of work on any particular contract, the amount of work ahead of the foundry, and whether or not an order is being turned out as cheaply as it should. The man who has charge of the pattern storage has a desk in the room over the pattern shop and from the end of his desk there is a small elevator or dumb waiter consisting of a small tin box which serves to carry orders from the foundry clerk to the man in charge of the pattern storage. When a casting order is made out, the foundry clerk places it in the tin box and rings a signal bell. The man in charge of the pattern storage draws the box up and attends to the order. This system saves both men a large amount of time. When the foundry clerk wants to see the man in charge of the pattern storage, he rings a large signal bell, that can be heard all through the pattern storage room.

OPEN HEARTH STEEL CASTINGS.

BY W. M. CARR.

In view of the growing interest in the production of steel castings and their increasing utility, it is proposed to put before the readers of *The Foundry* a series of articles treating of the salient points of their manufacture by the acid and by the basic open hearth processes. The articles will cover, (1) the selection and representative compositions of melting stocks, alloys, refractories, fuels, molding sands; (2) furnace construction, melting, manipulation of heats; (3) conditions of molding as affecting physical properties of products; (4) analyses and physical tests of different grades of product; (5) effect of constituent metals and metalloids usually present in open hearth steel castings; (6) heat treatment or annealing, with notes on the microscopic examinations in connection therewith; (7) blow-holes, shrinkage-cracks, etc., with a discussion of their causes; (8) repairing of certain defects by thermit welding; (9) special or alloy steel castings.

Materials for Acid Practice.

Melting Stock.—The composition of materials for acid castings comes within well defined limits, for the main reason that the process is nearer a melting, rather than a refining one, owing to the fact that the metalloids, sulphur and phosphorus, are not removed during the conversion of the charge. As their presence in the finished product must be subject to specification, it follows that the melting stock must be bought with a limit to the contents of the elements named. Only in regard to quantities of sulphur and phosphorus exists the distinction between acid and basic melting stock. Pig iron for ordinary practice analyzes as follows:

Total Carbon	2-3.5 percent
Silicon	.50-1.5 percent
Sulphur	.04 or less
Phosphorus	.04 or less
Manganese	.50-.75

In addition to pig iron, steel scrap known as "basic scrap" is also bought on analysis or chemical specifications. Being the product of rolling mills, etc., following basic practice, the contents of sulphur and phosphorus are usually low, and they are the only elements of composition taken into account. A representative analysis of steel scrap for acid practice is as follows:

Sulphur	.015-.03 percent
Phosphorus	.010-.03 percent

Since the physical character is usually represented by billets, crop ends, blooms, plate-shearings, defective castings and waste metal from steel foundries, the nature of them necessarily predetermines the composition in regard to the presence of carbon, silicon and manganese. With a charge of pig iron and steel scrap it is comparatively easy to keep the composition of finished product within acid specifications.

Refractories.

Silica sand forming the hearth of the furnace, known chemically as an acid, lends its classification to distinguish between the two processes. It does not present a condition wherein certain elements are removed during melting of stock, namely, sulphur and phosphorus. The amounts of those elements charged will be found in the finished product. The function of silica sand is mainly a refractory one. That is, it must have heat resisting qualities, but not to the extent that it will not set or sinter slightly to satisfactorily preserve the contour of the shallow dish-like formation of the hearth. It must not be too fusible, otherwise there would be excessive scorification or cutting of the hearth. It must set or sinter sufficiently to resist abrasion due to the charging of stock. It is difficult to lay down strict chemical specifications for silica sand. There are certain conditions of composition not expressed by an analysis of the total constituents. The combinations of them with their neighbors cannot be ascertained. However, a silica sand of the following analysis gave excellent results in practice:

Water	.24 percent
Silica	97.25 percent
Alumina and Iron Oxide	1.52 percent
Lime	.16 percent
Magnesia	.08 percent
Alkalies	.39 percent
Loss on Ignition	.36 percent

There are several deposits of silica sand in the West and Middle West that are supplied to steel foundries and no difficulty will be found in getting the best quality for the purpose. As a general rule a silica sand for

hearth lining must be low in lime, magnesia and the alkalies (potash and soda), an excess of any tends to lower the fusion point of the sand, destroying its required sintering or refractoriness. Usually a silica sand with less than 95 percent silica will not answer for a refractory.

Fuel.

It is a question of local conditions as to whether the fuel may be natural gas, oil, tar, or producer gas. Natural gas is by far the most satisfactory, owing to its high calorific value and its non-contamination of the bath or molten charge. It is fed directly into the working body of the furnace without any preheating or a passing through the regenerator chambers. Oil, next in efficiency, may be crude petroleum or a grade known as residuum; a by-product of petroleum distillation. The heating values are high, and in certain grades the composition will answer for acid work Some grades are rather high in sulphur, which is absorbed by the stock in melting.

Tar has been satisfactorily used when available as a by-product in the manufacture of coke by Otto-Hoffman retort ovens. The construction of burners permitted a simultaneous burning of the gas resulting from the coke retorts.

Producer gas is used extensively and when near a reliable supply of coal, considered cheaper than the aforementioned fuels. A description of gas producers and liquid fuel burners will be given in subsequent chapters. Gas distilled in a producer does not have as high a heating value as liquid fuels, nor is the efficiency so great, because much of the total heat units are lost in the process of distillation of the coal (soft or anthracite). With liquid fuels or natural gas the total thermal efficiency is available within the working body of the furnace, there being no intermediate losses before delivery at the point of combustion. Natural gas or liquid fuels are easy of control in flame regulation; furnace construction and repairs are simplified and lessened; regularity of product and longer campaigns are assured. Producer gas is irregular, and owing to heavy deposits of tarry and sooty matter, regular weekly stoppages must be made to clean out mains and flues. Liquid fuels or natural gas eliminate such losses of working time.

Heating Value of Fuels.

	B. T. U.	
Natural Gas....	300-600	per cubic foot
Oil	14000-17000	per pound
Tar	15000	per pound
Producer Gas..	100-150	per cubic foot
Bituminous Coal	10000-12500	per pound

One ton of bituminous coal yields in a modern producer, 160,000 cu. ft. of gas with 65 percent efficiency in heating value of the coal.

Alloys.

Ferro-Manganese.—The standard quality contains 80 percent manganese. A representative analysis will be as follows:

Iron	12-14	percent
Manganese	80.00	percent
Carbon	5-6	percent
Silicon	.5 -1.00	percent
Sulphur	.010- .03	percent
Phosphorus	.100- .75	percent

Ferro-Silicon.—The standard grade carries 13 percent silicon and is usually sold on a guarantee of 11 percent of that element. The following is a usual analysis:

Silicon	9-13	percent
Carbon	1- 2	percent
Sulphur	.04- .08	percent
Phosphorus	.10-.50	percent

In recent years there have been put on the market several grades of electrolytic silicons that are very satisfactory. The most economical grade is the one carrying 50 percent silicon, and considered on the basis of the unit cost of silicon, is cheaper than the commoner alloy. The following is a typical composition of an electric furnace ferro-silicon:

Silicon	50-52	percent
Iron	44-46	percent
Carbon	.15 -.25	percent
Sulphur	.003-.010	percent
Phosphorus	04 -.06	percent

The purposes of the aforementioned alloys will be considered farther on.

Iron Ore.—The purpose of iron ore is two-fold. One is to increase the fluidity of plastic slags, the other as a carrier of oxygen to assist in the removal of the carbon from the bath of molten metal. The total iron liberated in the interchange between its oxygen and the carbon of the bath adds to the yield of metal. The most satisfactory ores for open hearth practice are the magnetites or hard hematites. The soft

ores are apt to dissipate their combined usefulness in the slag instead of oxidizing carbon. No particular limits are placed on their compositions, excepting that they be high in iron and moderately low in phosphorus. A fair analysis is as follows:

Iron	60-68	percent
Silica	1-5	percent
Sulphur	.05-.100	percent
Phosphorus	.03-.500	percent

Molding Materials.—Since all steel castings are poured at higher ranges of temperature than gray iron or malleable castings, it is essential that the sands and clays (binders) be as refractory as possible. Pure silica is the most desirable—the purer the better. The following is an analysis of a typical steel molding sand:

Silica	98.5	percent
Alumina	1.40	percent
Iron Oxide	.06	percent
Lime	.20	percent
Magnesia	.16	percent
Combined Water	.14	percent
Alkalies	.25	percent

It must be of such a nature or structure physically that the heated gases in the mold when displaced by liquid steel will have a free passage outwardly. It is preferable that the grains be sharp and irregular rather than rounded as would be the case with sand subjected at some time to the action of water. The color is often white or slightly tinged with yellow. Its color is not necessarily a guide to its qualities, but it is often an indication.

Fire Clay.—Pure silica sand having no binding properties, varying amounts of clay are mixed with it to give the sand a needed bond and substantiality to the mold prepared for the reception of the hot steel. The clay must also be refractory and possess a maximum degree of plasticity. Low grade sands and clays would fuse at the temperature of liquid steel and cause the castings to be of an irregular rough surface. An attempt to economize in the sand pile is apt to spoil one's reputation for clean-looking castings.

It is not always reliable to have recourse to chemical tests on refractories or molding materials, since actual practice will affirm the desirable qualities in them. The following is a typical composition of fire clay:

Silica	60-66	percent
Alumina	25-20	percent
Iron Oxide	nil- 2.00	percent
Lime	nil- 1.00	percent
Magnesia	nil- 1.00	percent
Alkalies	nil- 2.00	percent
Combined Water	7.50-10.50	percent

The value of a fire clay depends largely upon a low content of alkalies and a freedom from carbonates of lime. Oxide of iron has a strong fluxing effect, but its presence below 3 percent is harmless.

Core Compounds.—Any reliable proprietary article will answer and the list will include molasses water, rosin, flour, linseed oil, etc., all of which are too well known to need any description.

Materials for Basic Practice.

Melting Stock.—In this particular basic melting possesses a marked flexibility in selection of stock over acid melting. It is by some considered a sort of metallurgical scavenger. While it is true that there are greater latitudes in quality of pig iron and scrap yet it must not be overlooked that the promiscuous dumping of any kind of stock into a basic furnace cannot yield a reliable product. If good castings are the object sought, discretion must be observed in the selection of materials entering into their manufacture. In regard to quantity basic pig iron greatly exceeds acid pig so far as availability is concerned. The ores of the Southern and South Western states are plentifully endowed by nature for the yield of unlimited supplies of basic pig. As to scrap, the situation is somewhat of an uncertainty, owing to the inroads made by the larger interests engaged in the production of ingots in basic bottoms, in consequence prices for scrap have a tendency to gradually rise. The factors controlling the choice between basic and acid practice for castings are ones of location and contiguity to the sources of supply of raw materials. So far as the relative value of the product of either process is concerned, it is true that basic castings are fully as satisfactory, from the view point of quality, as those made by the acid process. It must be remembered, one is a melting method and the other a refining one. The basic process to get good results needs intelligent handling and a higher development of melting skill. The pig iron necessary is known

as "Standard Basic" and the following analysis represents the ulterior limits in composition:

Silicon	1.00 percent
Sulphur	.05 percent
Phosphorus	1.00 percent

"Off-Basic" can carry as high as 1.50 silicon and again as high as .07 sulphur. Shipments of these grades on standard contracts can be accepted at a concession in price and it is permissible to use a moderate amount of "off-basic" in charges with no harm to follow. As was mentioned under "Acid Melting Stock" the sulphur and phosphorus charged in that process would equal that of the finished product. In basic melting it is possible to eliminate 50 to 75 percent of the sulphur and 95 percent of the phosphorus, thanks to the character of the lining of the furnace and slags formed by the liberal additions of limestone with the charge. For castings it is desirable to have on hand several brands of basic pig; some with low phosphorus and some with high manganese. Certain brands can be obtained with phosphorus as low as 200 while standard in other particulars and at ruling prices. Brands with high manganese ranging from 1.5 to 3.00 percent command a higher price. It is not good practice to make the entire pig iron charge high phosphorus stock. The reasons for mixing brands in regard to phosphorus and manganese will be considered under furnace manipulation.

Steel Scrap. The character of this material is not considered chemically because the physical nature of it brings it well within working limits as to composition. It is usually designated "heavy railroad melting scrap" but liberties are sometimes taken and unless the consumer exercises circumspection almost anything may be found in it from shop sweepings to tomato cans. *Heavy* scrap is the desideratum, and may consist of, as an illustration, steel rails, knuckles, draw bars, wheel centers, car-springs, fish-plates, defective castings (steel), ingots, etc. Gray iron castings should be religiously excluded when sold as steel scrap. It is allowable to use limited quantities of defective malleable castings although draw bars of such materials are sold as steel. Five percent of the scrap charge in malleable scrap will not upset the melter's calculations. The scrap charge will be augmented by daily waste from the foundry.

Refractories.

The hearth of basic furnaces in American practice is made with magnesite a substance classified chemically as a base and possessing the quality, in addition to resisting high temperatures, of being but slightly affected by a slag highly charged with lime which would be fatal to a hearth lined with silica sand. To lengthen the life and efficiency of a basic hearth the first consideration is to keep out of the charge as much silicious matter as possible. Magnesite, the carbonate of magnesia is an importation from Austria, where it is calcined converting it into magnesia, the oxide of the metal magnesium, by the removal of the major portion of carbon dioxide. It is still considered commercially as a magnesite. Its composition ranges as follows:

Raw.

Magnesium Carbonate	93.19 percent
Calcium Carbonate	1.43 percent
Iron Carbonate	2.61 percent
Silica	2.75 percent

Calcined.

Magnesia	90-95 percent
Lime	1-2 percent
Iron Oxide	.5-3.50 percent
Silica	.5-2.75 percent
Volatile Matter	.5-1.00 percent

Dolomite. This material is extensively deposited in the United States. It is a double carbonate of lime and magnesia. It is used either calcined or raw. Principally it is used for patching slag lines, where scorification of the hearth is the heaviest. It is not recommended for points below the slag line. A typical analysis is as follows:

Raw.

Silica	.5-2.00 percent
Iron Oxide / Alumina	.5-2.00 percent
Calcium Carbonate	50-55 percent
Magnesium	40-44 percent

Calcined.

Silica	.5-2.00 percent
Iron Oxide / Alumina	.5-2.00 percent
Lime	50-55 percent
Magnesia	37-45 percent

Chrome Ore. A substance highly refractory to heat and neutral to the action of acid and basic slags. Unfortunately it has no

bond and for that reason its uses are somewhat limited. It is used for patching parts of the hearth where cutting above the slag line is severe upon the brick work, usually in gas ports and door jambs. (In European practice it is stated that entire hearths are lined with lump chrome ore.) Aside from patching it is used as a neutral lining between magnesite and silica bricks. Its composition is as follows:

Chromic Oxide	40-60 percent
Iron	15-18 percent
Alumina	5-30 percent
Silica	1-5 percent

Fluxes.

The most efficient in basic melting is ordinary limestone. Its function is to form a slag that will readily absorb the sulphur and phosphorus of the charge and act as a vehicle for the oxidizable silicon iron and manganese. The purer the grade the better, that is, a richness in carbonate of lime and a freedom from silica.

A fair analysis is as follows:

Silica	.25- 1.00 percent
Oxide of Iron and Alumina	.50- 2.00 percent
Carbonate of Lime	95. -99.00 percent
Carbonate of Magnesia	.5 - 1.00 percent

Fluorspar. The function of this material is to thin a limey slag when in the judgment of the melter it seems thick or sluggish. A moderate addition of fluorspar will liven it and its action may be likened to certain fluxes used in brazing metals—the property of dissolving at higher temperatures metallic oxides. It is plentifully deposited in the United States. A good grade will analyze as follows:

Calcium Fluoride	90-98 percent
Oxide of Iron and Alumina	.5-1.00 percent
Silica	nil-1.00 percent

Iron Ore. See "Acid Melting Materials."

Alloys. See "Acid Melting Materials."

Fuels. See "Acid Melting Materials."

Molding Materials. See "Acid Melting Materials."

As a guide to purchasing stock the following tabulations will be of assistance in furnishing approximate amounts for regular consumption. The figures are based on the different kinds of stock necessary to produce 1 net ton of castings:

	Acid Practice	Basic Practice.
Pig Iron	620 pounds	1227 pounds
Steel Scrap	1880 pounds	1227 pounds
Ferro-Silicon	54 pounds	57 pounds
Ferro-Manganese	28 pounds	35 pounds
Iron Ore	26 pounds	30 pounds
Chrome Ore		5 pounds
Aluminum	3-10 pounds	3-10 pounds
Limestone		300 pounds
Dolomite		85 pounds
Fluorspar		13 pounds
Magnesite		34 pounds
Silica Sand	1800 pounds	1600 pounds
Fire Clay	300 pounds	350 pounds
Gas Coal	950 pounds	1250 pounds
Fuel Oil	55 gallons	80 gallons
Boiler Coal (power)	900 pounds	900 pounds

FALSE ECONOMIES.

BY JOHN MCCUNE.

In the September issue of *The Foundry*, Dr. Kirk had an article, entitled "Cost Keeping," in which he proceeded to roast modern methods very thoroughly, and the article provoked the following thoughts: In most of the cases in which foundries have failed, when they had extensive cost-keeping systems, an investigation will show that, while there may have been an extensive cost-keeping system, there was a lack of practical foundry brains and no amount of juggling the figures or careful bookkeeping will ever enable a man who knows nothing about the foundry business to force some one else who knows nothing about it to produce castings at a profit with cheap material, cheap supplies and cheap help.

As a plant grows the time comes when it is no longer possible for one man to carry all of the detail information necessary concerning it in his head, and at this time in the history of a plant methods should be devised for getting as much of the burden off from the management and into or onto the accounting system books as possible.

For instance, a pattern record system should be devised which is as near automatic as possible, and then it should be some one person's duty to see that the system has a chance to work. Any account-

ing system will be a failure if everybody has to keep some of the accounts. In a properly arranged accounting system the workman should never have to make any records or do any writing unless it is to sign his name. Times, dates, etc., should be kept by suitable stamps and time clocks, and all other clerical work should be done by someone connected with the time keeping department.

In most cases it will be found more profitable to place a local office in each department, and to control the work of each department from the local office. In place of taking the authority away from the foreman, this places in his hands a very efficient means of following up the work and of judging each man's ability. To put the whole matter in a few words, all cost systems should be an aid to shop management, and should leave the manager himself free to devise means and devices to carry on the work to better advantage.

Where the office attempts to run the shop fearful blunders are sometimes made. The writer had occasion to visit one of the prominent foundry plants in this country a year or two ago, and upon looking down the cupola discovered that a 60-in. cupola was practically bridged over with a great accumulation of exceedingly hard and tough slag. It took two men several hours to chip and bar out this mass, and in so doing they damaged the lining greatly. An inquiry as to the cause of this brought out the fact that the foreman had put in a requisition for limestone, on which, according to the rules of the company, he stated the amount then on hand, and the day on which he would want it. A bookkeeper in the cost department discovered that if the shipment was held back a few days it would go into next month's account, and hence delayed the order. A delay in delivery aggravated the matter, and the result was that this company had to foot a bill which probably ran into hundreds of dollars, for additional damage to cupola lining, time spent in chipping out heavy accumulation of slag, time lost on account of slow melting due to the stopping up of the cupola, and lastly in bad castings resulting from dull iron due to bad melting toward the end of the heat. Had the ordering of these supplies been in the hands of some one more closely associated with the foundry, such a delay as this would have been avoided.

Another case which illustrates the folly of absent treatment on the part of the office for foundry ills is that of a large foundry having three traveling cranes. The crane operators received, we will say, $2.25 per day. The cost keeper decided that a crane hand was only one form of laborer, and cut them to $2 per day, and three men quit very promptly and three laborers were put in their places.

It happened that the work of the shop was taxing the crane capacity severely, even when they were handled by expert men, so that when they were handled by green men the molders were unable to obtain the amount of crane service necessary. This necessitated a large amount of lubber lifting in the case of medium sized work, and in serious delays on the part of high-priced molders while waiting for the services of the cheap crane men. In other words, to save 75 cents per day this office man reduced the output of the foundry over 10 percent, and increased its pay roll considerably on account of the fact that it was necessary to hire a couple of additional helpers to do some of the work that had formerly been done by the cranes. This condition of affairs lasted over six months, and it was not until a number of changes had been made that skilled operators could be secured, and then they could only be held by paying the old wages.

It is certainly bad policy for anyone to interfere with supply services which are needed by the entire industrial force, as in the case of the cupola or the crane.

The writer believes that a large modern plant cannot be run without modern cost keeping and cost finding systems, but that these systems must be under the direction of men who have the brains and experience to interpret the results and to work by them understandingly. No amount of new appliances, molding machines or special machinery can ever take the place of brains in the management.

The U. S. Foundry & Sales Co., of South Norwalk, Conn., reports that its plant is exceedingly busy and that the recent increase in the capacity of the plant was made none too soon.

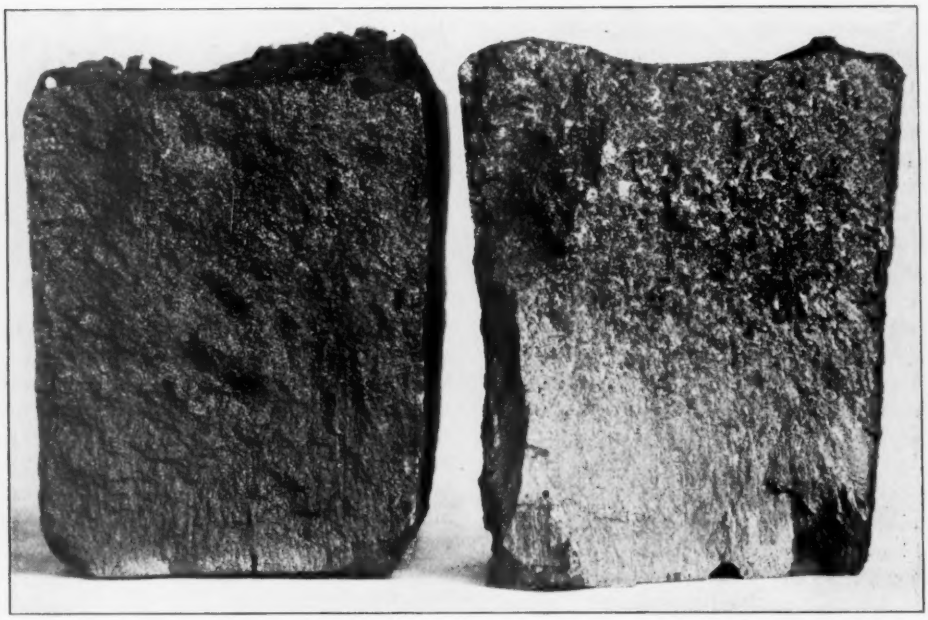


FIG. 2. FIG. 1.

COST OF AIR FURNACE AND CUPOLA CASTINGS.

BY L. G. BLUNT.

The object of this article is to show that the cost of melting iron in an air furnace as compared with that in a cupola is not as expensive as is often pictured. It is useless for the writer to go into a detailed discussion of this subject, as the class of work and the daily tonnage play such an important part in the cost sheet. Therefore, he will only cite a few results from his experience in making castings from the same patterns with the use of air furnaces and with cupolas.

In a large shop making heavy castings it will be found that the labor on the air furnaces costs about three cents per ton more than on cupolas, and the repairs about seven cents per ton more. Fuel for the air furnace costs about eight cents less per ton of metal melted than is the case in cupola practice. On a regular "coke" pig iron and scrap mixture the cost is $1.50 per ton cheaper than in the case of the cupola mixture.

If the castings from the cupola were required to have the same strength as those from the air furnace, one would have to use charcoal iron in the cupola, and this would give the air furnace more of an advantage over the cupola.

In the air furnace a refining action may be carried on and changes brought about in the iron. This would be impossible in the cupola. The extent to which this refining action can be carried is well illustrated by the accompanying illustrations. Fig. 1 shows the fracture of a preliminary test which was taken on an 80,000-lb. heat. This test piece contains .5 percent silicon and 3.50 percent total carbon. In this case it was desired to have 1.35 percent silicon and 3.02 percent total carbon. After a treatment of an hour and a half in the furnace the test piece shown in Fig. 2 was taken, which is the desired composition and the fracture tells its own story. The total carbon had been cut down and the silicon raised.

In Fig. 3 is shown a test piece from a burned heat whose silicon content was .9 percent and the total carbon 3.20 percent. During the next hour the silicon content was raised to 1.20 percent and the total carbon held at 3.18 percent, when the test piece shown in Fig. 4 was taken. In this last case the furnace contained a charge of 70,000 lb.

The idea of showing these tests is to

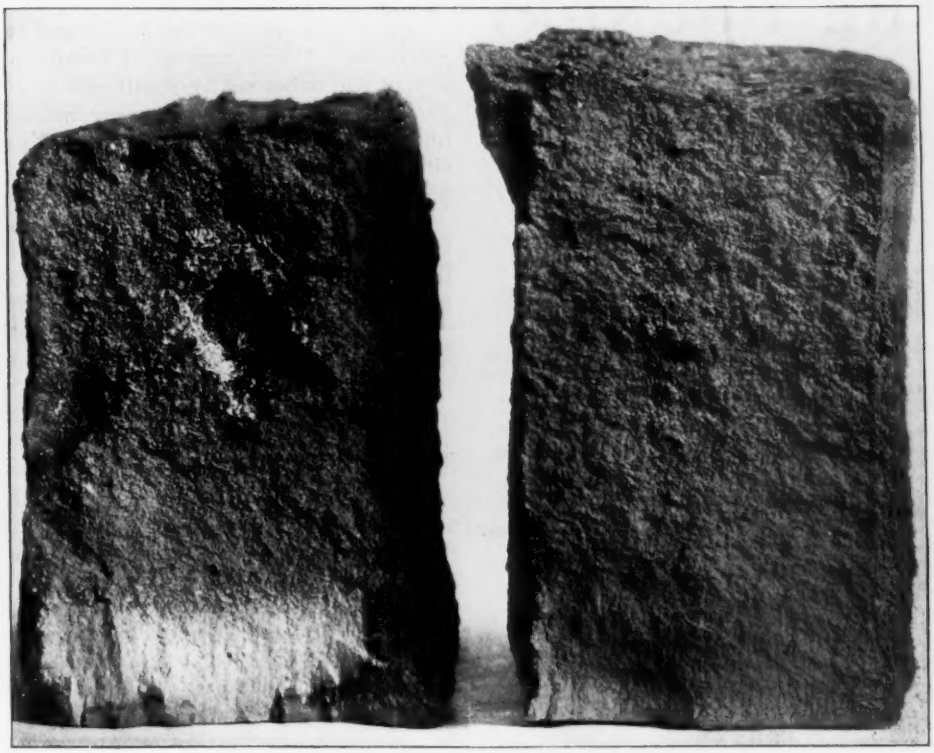


FIG. 3. FIG. 4.

illustrate the thorough control that one has over the air furnace. Any one making high class castings will find that the use of the air furnace will assist him in keeping the percentage of loss down. It will also be found that the inspector will not have to close one eye to pass castings, as he often has to do when they are made from cupola metal.

NEW BOOKS.

"The Competent Life," by Thomas D. West, published by the Cleveland Printing & Publishing Co., Cleveland, O. 5 x 7¾ inches. 245 pages, 25 illustrations. Price $1.25.

The author of this work, Thomas D. West, has long been well known to the American public and especially to the foundry industry, as a writer on foundry subjects. When only a small boy his father died and little Tommy had to scratch for himself. He learned the molder's trade and has worked through to an important and lucrative position. Most of his education has been gained from home study and reading. In the last few years Mr. West has been devoting his leisure time largely to the writing of a series of essays dealing with sociological problems relating to American industries. His training has especially fitted him for seeing the world from an angle from which few writers see it. The present book is the result of these studies as to the present social conditions in this country and how American citizenship can be advanced.

Among the chapters are the following: "Responsibilities of Civilians," "Man's Need of a Boss." "Demands for Intelligence and Skill," "Qualities Necessary to Achieve Success," "Need of Technical Education," "Cause and Extent of Poverty and Pauperism," and many other chapters dealing with American life as it is today. This work will be found of interest by all who are considering these problems, especially on account of the fact that the view point of the writer is somewhat different from that of most writers. In the preface the author states that he claims neither title nor degree and does not seek the appellation of man of letters, but that he does claim to be the bearer of principles, truths and suggestions whereby the development of more competency can be brought about.

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TRADE OUTLOOK.

In the trade outlook for December, 1904, we stated: "For a number of months preceding November we were only able to sing the same old song of uncertainty and waiting conditions in the market, with an occasional slight advance, but a considerable portion of the foundry capacity idle. We are glad to report now that things have taken a definite turn for the good." During the year that has passed since that time the turn for the good has certainly developed into good times, and today practically all the foundries in the country are busy working full time and some of them are crowded beyond their capacity. This condition in the foundry trade is paralleled by a similar condition in the steel business, so that today all of the interests using pig iron are exceedingly busy and the blast furnaces are taxed to their maximum capacities.

During the past month many factors have been especially favorable to a large pig iron output and it is claimed that the output was at the rate of about 25,000,000 tons of pig iron per year. It will as a matter of course be impossible to maintain this rate through the coming winter, on account of the fact that cars are exceedingly scarce, the coke supply is hardly adequate to the demand, and many of the furnaces will have to be blown out for repairs, and despite the fact that there is a larger tonnage of ore now on the docks and in furnace yards than ever before, it is probable that before spring there will be an ore shortage which will seriously curtail furnace operations in some quarters.

All of these factors taken in connection with the large number of orders on hand, both in foundries and steel works, have tended to an increase in prices in all raw materials. It is probable, however, that a much greater increase in the price of raw materials would act to reduce outputs in many lines to a large extent, and hence that the market cannot go much higher than at present. In traveling among the foundries the writer has been interested to note that a very large proportion of the small or medium sized foundries have a considerable tonnage of iron in their yards, showing that many of them have taken advantage of the low prices.

A number of large orders have been placed recently, including one from the U. S. Cast Iron Pipe & Foundry Co., placed with Buffalo and Virginia furnaces. No. 2 foundry iron is selling at from $19 to $20 per ton in Chicago and in the neighborhood of $18 per ton at the Valley furnaces. Southern foundry iron is selling at $14.50 per ton for No. 2 foundry at the furnaces. Foundry coke is scarce and it is nearly impossible to get cars for its shipment so that many purchasers are ordering the coke dealers to ship in open or on rack cars, claiming that they are willing to take any kind of a car, just so they can get the fuel.

The heavy gray iron foundries which were the last to feel the effect of the good times are now very busy. The steel and malleable foundries are also well supplied with orders.

CARNEGIE TECHNICAL SCHOOL.

In the latter part of October, an event of unusual importance occurred in the history of technical education in this country. This was the opening of the school of applied science in the first building completed at the Carnegie Technical Schools in Pittsburg. The course mentioned represents but a mere fraction of the work which will be carried on when the schools are completed, and the interest taken by the public in the schools can be judged from the fact that the statement that the course in applied science was ready, brought out 1,723 registrations for admission to the classes, in spite of the fact that only 120 students could be accomodated. Of these registered however, all but 604 were rejected for reasons other than lack of accommodation on the part of the school. The 126 successful applicants were selected by competitive examinations. The remainder of the 604 will be eligible as soon as the accomodations are completed so as to provide sufficient space to receive them. Very little has been done to advertise the school, but those in charge have been carrying on the work with great energy. It is announced that with the amount of money available, those in charge of the school will be able to secure the best possible teachers. One feature in the selection of the faculty, which is worthy of mention, is that a great deal of importance is placed upon the amount of practical experience which the applicant has had.

STANDARD SIZES FOR CATALOGUES.

It is strange how some people can sleep through a sermon and the entire reform movement which follows it and after everything is decided, wake up and start a reform campaign of their own, which in reality only results in confusion for everybody. Some 15 years ago the question of standard size for catalogues was extensively discussed by a number of engineering societies, and the committees appointed by them recommended 9 x 12 as the largest size; 6 x 9 for the regular catalogue size; 4½ x 6 for medium size catalogues and 3 x 4½ for a small or pocket size catalogue. The *American Machinist* changed the size of its paper to correspond to the 9 x 12 standard, and since that day most of the leading technical papers have adopted the standard size. Among these we may mention the *Engineering And Mining Journal, Power, Mines And Minerals, Hardware And Metal, The Electro Chemical And Metallurgical Industry, Fuel, Woodcraft, The Boiler Maker The Marine Review* and *The Iron Trade Review.*

The 6 x 9 size for catalogues has been adopted by practically all of the largest manufacturers, such as the Westinghouse Companies, the Allis-Chalmers Co., the Link Belt Engineering Co., etc. The Link Belt Engineering Company publishes on the outside of its catalogues "6 x 9 standard size, as recommended by the American Society of Mechanical Engineers."

One of our subscribers recently wrote in asking for the proper size for a catalogue. We gave them a statement something as above and they adopted the 6 x 9 standard, but we have just received a letter from them calling our attention to the fact that the Southern Hardware Jobbers' Association has appointed a committee on standard size of hardware catalogues that has recommended 8¼ x 11 in. as the standard size for regular hardware catalogues, and 9½ x 11 as the standard size for loose leaved catalogues. It must be that our Southern friends are still in their old prebellum sleep and have not, as yet, awakened to find that the world do move. When a matter has been as thoroughly threshed out as this standard size catalogue matter has, and has been in use for a decade and a half, it certainly tends to confusion to have some other association come along and set up a standard of its own.

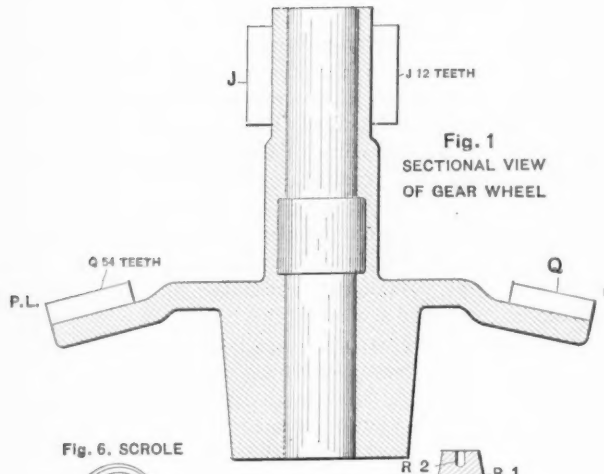


Fig. 1
SECTIONAL VIEW
OF GEAR WHEEL

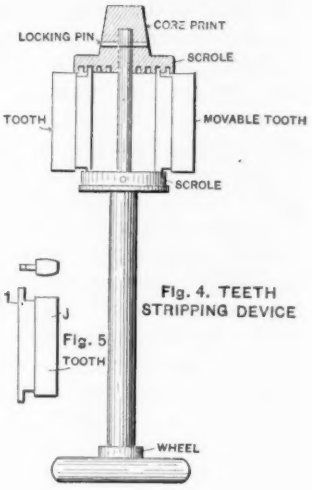


Fig. 4. TEETH STRIPPING DEVICE

Fig. 5

Fig. 6. SCROLE

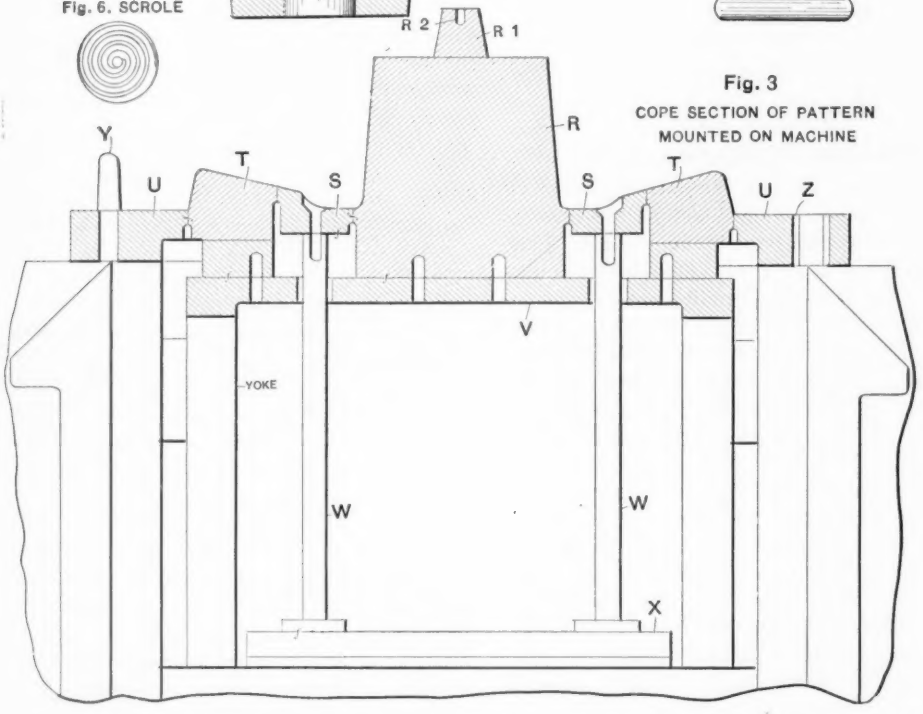


Fig. 3
COPE SECTION OF PATTERN
MOUNTED ON MACHINE

MOLDING MACHINE PRACTICE.

BY F. W. HALL.

In the construction of certain classes of machines there are classes of castings of peculiar shapes, which are not always designed by practical machine designers, and very little thought is given to how the pieces are to be made. The designer, of course, has no doubt that they can be made, and he is right in this supposition, but not far-sighted; for often to make these pieces requires some difficult coring or patternmaking. What the designer is really doing is shifting his responsibilities on to the pattern shop and foundry. When one of these odd pieces comes to be mounted on the molding machine, the molding machine man usually has troubles of his own, and is sometimes at his wits' end to know how to mount it and still have it a profitable job. In some cases all of the special devices which he has used in the past on other difficult jobs, fail to answer for the case in hand.

The job illustrated in the accompanying

drawings is one which required the getting up of a special device which may be a new wrinkle to many.

Fig. 1 shows a section through a special gear wheel used on a harvesting machine. It will be noted that there is a very flat bevel gear combined with a small 12-tooth pinion. In the old style of molding, this would be made either in a three-part flask or would be made with the use of a number of cores. Three-parted jobs are more expensive than two-parted, and additional cores always make expense, so that a good molding machine man always tries to reduce every piece to a two-part job, and to cut out all the cores he possibly can. In the case in hand this is accomplished by introducing a special tooth-stripping device, shown in Figs. 2 and 4. Such a device as this is expensive to install, but if well made will last a long time and be a money-saver upon a large output.

The 12 teeth in the gear are about 7-16 in. high, and the diameter of the hub upon which the teeth are cast is sufficient to allow a central chamber into which the teeth may be stripped. A device of this kind could not be applied to a hub the diameter of which was less than four times the height of the tooth.

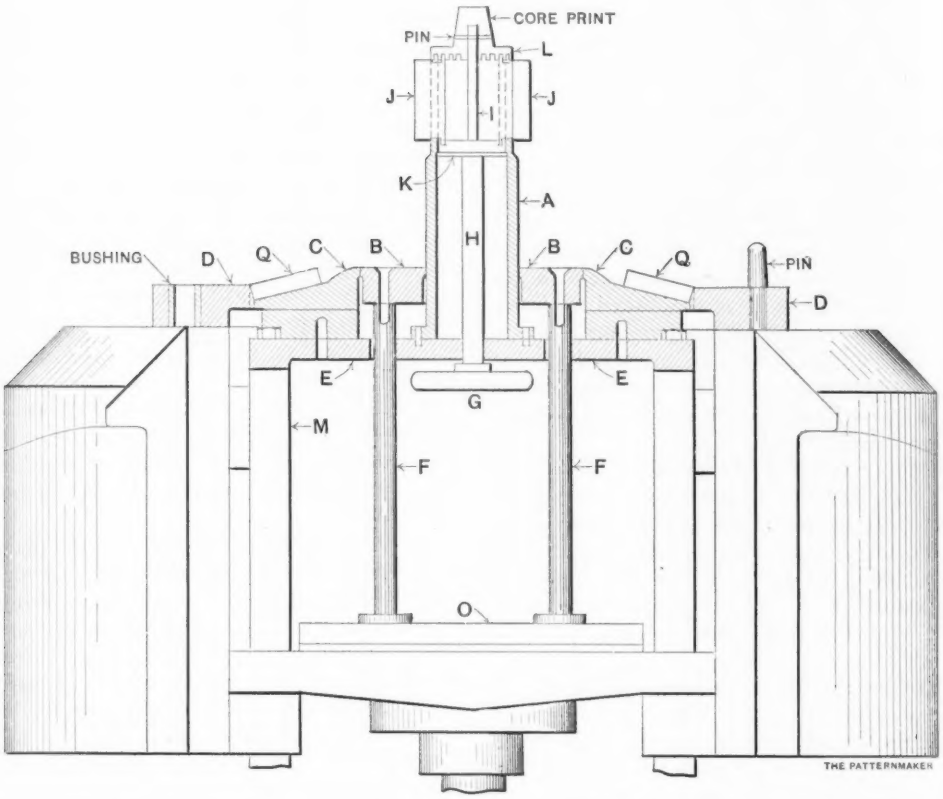
The bevel gear has 54 teeth, and by noting the form of this gear in Fig. 1 it will be seen that the parting line comes at such a point that the teeth are all made in the drag, as shown in Fig. 2. The molding machine used in this case is a drop pattern machine of the Paxson-Hall type and the job is made in a round iron flask. It is hand-rammed like all machine jobs made through strippers. It requires two patterns, one for the cope, and the other for the drag.

The section of the hub A, Fig. 2, is stripped by the stripper B, which is mounted on four stools, F. The top face of the stripper B acts as the face of the pattern. It should be stiff and strong, and cut to the shape shown at B, Fig. 2, the piece being finished all over and made from cast iron. The outer ring of the pattern marked C has 54 teeth on it, as shown at Q, and this needs no positive strippers on account of the great draft and slant of the teeth. If the teeth are finished smooth the sand will not tear up. The piece C is also made of cast iron, and should be thick and strong to be sure that it will retain its shape. It is fastened to the upper face of the pattern plate, E. The parting line runs from the top of the teeth at the points to the bottom of the teeth in the spaces.

The third section of the pattern for this portion of the machine is the hub A. This can also be made of iron, a wooden master-pattern being required for it. The hub A is finished all over and screwed to the plate E by means of screws. The special stripping device shown in Fig. 2, and in greater detail in Fig. 4, is fitted into the upper end of the casting A. The openings for the teeth J to strip through can be cut after the hub is finished in all other respects. The upper end of the hub A should be turned down a little smaller than the body, to receive the cap L, which carries the upper scroll for stripping the teeth. The outer face of L goes flush with the outer face of the hub at the bottom of the teeth. A shoulder is turned on the inside of A to fit the lower scroll K, and prevent it from being displaced.

The outer stripping plate, D, pattern plate E, and stool plate O, are simple in construction and need no special explanation. After these parts are finished and put in place, a hole is drilled in the pattern plate E to receive the spindle or rod H, which operates the stripping mechanism. The teeth to be stripped are made as shown in Fig. 5, J being the tooth, and JI the connection which holds the tooth to the stripping mechanism. The teeth are made of steel and hardened. In order to strip the teeth inward, two scrolls are necessary, which take hold of the points JI. One of these scrolls is shown in detail in Fig. 6. The scrolls are both made of steel and hardened. The spindle H is made of ½ in. cold-rolled steel, the upper end being turned down to ¼ in. diameter, and fitted to the scrolls, as shown in Fig. 4, in which view the upper scroll is shown in section. Of course it will be necessary to fit each tooth to its particular place in the scroll, and the exact distance from points JI to the top of the teeth will vary with each succeeding tooth. The lower scroll is pinned to the spindle, and the spindle and scroll introduced into the piece A. The teeth are then assembled in place, the upper scroll adjusted and pinned in place. The hand wheel G is secured to the lower end of the spindle and by turning the hand wheel

Fig. 2
MOULDING MACHINE OF PAXSON-HALL TYPE
WITH SECTIONAL VIEW OF SPECIAL GEAR
MOUNTED ON IT.



the scrolls can be rotated so as to draw the teeth in or force them out.

In fitting the piece, C, with the teeth, Q, to the plate, D, it will be necessary to cut grooves through the plate, D, for each of the teeth to strip through. These are formed by assembling the plates, scribing the outline of the teeth on the plate, D, and then cutting them through, after which the parts are tried together and brought to a perfect fit with the use of some marking material, such as red lead. It will be noticed that practically all of the parts for the machine shown in Fig. 2 can be finished on the lathe, and it is always cheaper and better to do work on the machines whenever possible, as greater accuracy is thus assured than can be attained in hand work.

About three revolutions of the hand wheel, G, will strip the teeth, J, into the hub, so that the hub and piece, A, may be stripped downward without tearing up the sand.

The cope machine is rigged up as shown in Fig. 3, the pattern being in three sections. The portion S serves as a strip-plate for the hub, R, and the outer portion of the rim, T. It will be necessary to make wooden patterns for the parts T, S and R; but the wood patterns made for the pattern plate, stool plate, and outer stripping plate for the drag machine will serve for this machine also. It will be noted that in this case, as in the case of the drag machine, nearly all of the patterns are round and can be finished on the lathe. The print, RI, is fitted with four brass strips, screwed to the side for runner, and the hole, R2, is drilled in the center of the print to receive the sprue. The pins, Y, and bushings, Z, must be made and placed in the plates, D and U. The print, RI, is made somewhat longer than the core-

print for the drag machine, and the core-box made with both prints of the same length. This insures a space on top of the upper end of the core, which connects the sprue with the four spaces left by the brass gates screwed to the print, RI.

In making a mold the lever on the drag machine is thrown up so as to elevate various parts through the stripping plates. Facing sand is sifted in, heap sand shoveled in, the mold rammed and struck off, the operator then reaches under the machine and by turning the hand wheel, G, strips the teeth, J, into the hub, A. He then throws down the lever at the side of the machine, thus stripping the hub, A, and the patterns, C, carrying the teeth, Q, from the sand. The mold is then lifted from the sand and placed on the floor. The cope is then made in the same manner by placing the flask into position, introducing sand, ramming it, striking it off, and stripping the hub, R, and portion of the pattern, T, shown in Fig. 3, down from the mold by the operating lever. The core is set in the drag, and the cope placed in position, thus completing the mold.—[*The Patternmaker.*

FOUNDRY FACINGS.*

BY W. G. SCOTT, RACINE, WIS.

Under the head of "Foundry Facings" may be included the following material, viz.:

Plumbago, graphite or black lead;
Soapstone or talc;
Sea coal or bituminous facing;
Hard coal or anthracite dust;
Coke dust;
Wood charcoal;
Lycopodium;
Parting sand, mill dust, etc.

The object of a facing is to prevent the sand from adhering to the casting and to produce a smooth surface on the iron.

It must be of a refractory nature and not burn away before the molten metal; it must also adhere to the surface of the mold and cause the castings to "peel" readily when shaken out of the sand.

Such material may be termed a refractory facing and is, literally speaking, a true facing.

Graphite, often called plumbago, black-lead, or silver-lead, stands at the head of the refractory facings.

Soapstone or talc is another refractory material, but owing to certain objectionable features, to be described later on, is seldom used alone as a facing, yet is often present as an adulterant in many cheap facings.

Coke dust and hard coal (anthracite dust) are occasionally found to be present as an adulterant of graphite and, owing to the fact that they are nearly pure carbon, it is a difficult matter for the foundryman to detect the fraud.

Another class of facings, termed combustible facings, are used to prevent the fusion of the molding sand, and instead of being applied to the face of the mold the material is mixed with the sand, consequently is a "mixer" instead of a facing.

Sea coal facing belongs to this class and is the only facing known which is not put on the face of the mold.

It is generally mixed in the proportions of one shovel full of the pulverized coal to five, up to twenty shovels of sand, according to the size and weight of the casting to be made.

The coal is mixed with that portion of the sand which is nearest to the surface of the mold, in order to "rot" or break up the particles of sand coming in contact with the fluid iron.

The heat from the red hot iron attacks the coal, consuming much of it, and allows the gas to escape by way of the porous interstices, otherwise the sand would be fused to a glass like mass.

Sand mixed with coal is generally called "facing sand," and as only a small depth of such sand is needed, the molder should use some judgment as to the proper thickness.

Anthracite coal dust, also coke dust, are sometimes used in place of soft coal facing.

Another class of material often spoken of as facings, include such substances as wood charcoal, lycopodium, parting sand, mill dust, etc.

Such material being used for "parting" can not be termed a facing, but on account of their use in connection with the true facings this article would not be complete unless they were given some attention.

Facings are applied in different ways, according to the class of work, the kind of mold (dry or green sand) and the idea of the workman.

In some cases the graphite, clay, etc., is mixed with weak molasses water, stale beer or other similar binder or sizing and applied to the face of the mold, the surface being finally "slicked" by means of a proper tool.

Such treatment generally applies to dry sand molds and cores, but in green sand work where the mold already contains moisture, the facing is dusted on by means of a "dust bag" or with

*Paper read at A. F. A. Convention, New York, June, 1905.

a camel hair brush, then the excess of facing removed with the hand bellows.

As before stated, the object of a "facing" is to produce a perfect separation of iron and sand, while the object of a "parting" material is to facilitate the separation of the matched parts of the upper and lower parts of the mold (cope and drag), therefore the essential properties of a "parting" material are non-adhesiveness and proof against moisture.

It is not the object of this paper to go into the details of applying and using facings, etc., but to describe the different grades of material and give a suitable method for testing the quality—therefore each class of such material will be considered in its proper place.

Sea Coal Facing.

Sea coal facing should be made from the very best quality of soft coal, free from slate, sulphur, phosphorus and other detrimental impurities.

The best "gas coal" makes the best sea coal facing and as the Youghiogheny district furnishes the most perfect product, an analysis of such will give a good idea as to the proper composition.

(1) Proximate analysis of Youghiogheny gas coal:

Moisture		1.00 percent.
Volatile matter	=	35.00 "
Fixed carbon	=	58.07 "
Sulphur	=	.33 "
Ash	=	5.60 "

This coal has a specific gravity of 1.280 compared with distilled water as 1.000.

The amount of coke produced from the above would be 63.67 percent.

(2) Cannel coal is frequently used for facing and by some founders is preferred to the Youghiogheny.

The analysis is as follows:

Moisture	=	3.30 percent.
Volatile matter	=	48.50 "
Fixed carbon	=	42.00 "
Sulphur	=	.20 "
Ash	=	6.00 "

This coal has a gravity of 1.229 and produces about 48.00 percent of coke.

The volatile matter is extremely high, and owing to its oily nature it is a question as to its fitness for a good facing.

The above analyses are supposed to represent the average composition of such coals, but all coal is subject to variation, especially in regard to the amount of moisture and volatile matter present.

Sulphur is a detrimental ingredient in coal and if high is liable to cause the surface of the iron to be hard, producing what is called a "sulphur skin" on the casting.

Phosphorus is seldom present in quantity sufficient to affect common cast iron.

In making an analysis of sea coal facing, the particular points to be noted are sulphur and ash.

If the sulphur exceeds 0.75 percent it may be assumed that an inferior grade of coal has been substituted, and if above 1.50 percent the facing may be looked upon with suspicion.

Where the ash exceeds 8.00 percent, it is evident that some slaty material is present, but the facing should not be condemned on this account unless the ash exceeds 11.00 percent.

The poorer grades of coal contain a large amount of sulphur, varying from 1.50 to 7.50 percent, and the ash in certain cases is extremely high.

Slack, culm, etc., are often ground up for facings and as an adulterant for sea coal, in which event the increase in ash is a guide as to the quality, some grades of slaty coal, slack and culm having as high as 33.00 percent of ash.

Graphite Facing.

The purest graphite contains about 99.90 percent of carbon. Such material, however, is too expensive to be used as a facing, owing to the fact that it is necessary to purify the natural product in order to obtain this high purity.

A superior natural graphite much used for facings contains about 75.00 percent of carbon, and is used for high class work.

Inferior grades of natural graphite contain carbon varying from 15.00 to 65.00 percent, and as the regulation method of determining carbon in facings consists in burning off a weighted amount of the sample and calling the loss carbon, it is an easy matter for the unscrupulous dealer to add a certain amount of coke or anthracite dust so as to raise the carbon content to a point equal to that of a commercially pure graphite.

There are several methods for determining this sort of adulteration, but they are not absolutely reliable.

If we fill several small beakers with water and then from the end of a spatula carefully sprinkle pure graphite, coke dust, anthracite dust, soft coal dust and wood charcoal on the surface of the liquid it will be found that none of the powders will settle except coke dust and some charcoals.

The reason for this is that the oily or greasy matter forms a film on the surface of the water and prevents settling, consequently this test only distinguishes coke and non-greasy charcoal.

By shaking in a test tube, about a quarter of a gram of the powder mixed with 15 c. c. of acetone, and allowing to stand ten or fifteen minutes it will be observed that pure graphite settles clear, leaving the liquid colorless; coke dust imparts a gray color to the solution and remains in suspension a long time; anthracite dust imparts a faint brown color, and settles more rapidly, while soft coal dust imparts a deep brown color to the acetone.

Equal parts of glacial acetic acid and sulphuric ether answer as well as acetone for such a test.

The above tests are qualitative only and of no value as a quantitative method.

The regulation method used in the analysis of facings is known as a "Proximate Analysis" and is the same as that used for coal.

The following analysis of graphite, coke dust, coal and charcoal will give a general idea as to the peculiar character of the different forms of carbon.

The purest graphite designed for commercial purposes seldom exceeds 99.00 percent in carbon as previously stated, but it is possible to obtain what is termed "commercially pure" graphite containing about 95.00 percent of carbon, and such material is used to a great extent as a lubricant.

For facing purposes the carbon content is generally lower, varying from almost nothing up to 75 percent.

The following proximate analysis also gives some idea as to the different grades.

Sulphur may be stated as a separate quantity or included in the analysis by subtracting half of the amount from the volatile matter and half from the fixed carbon, therefore if preferred the sulphur may be considered separate and the analysis made good by adding half the sulphur to the volatile and fixed carbon content.

(3) Analysis of pure graphite—C. P.:

Moisture	=	.02 percent.
Volatile matter	=	.09 "
Fixed carbon	=	99.79 "
Sulphur	=	none
Ash	=	.10 "

(4) Analysis of commercially pure graphite:

Moisture	=	.15 percent.
Volatile matter	=	.79 "
Fixed carbon	=	94.60 "
Sulphur	=	trace
Ash	=	4.46 "
Specific gravity	=	2.293

(5) Analysis of "stove plate" graphite facing:

Moisture	=	.75 percent.
Volatile matter	=	5.29 "
Fixed carbon	=	56.10 "
Sulphur	=	.20 "
Ash	=	37.66 "
Specific gravity	=	2.363

The composition of the ash (37.66 percent) is as follows:

Silica	SiO_2	=	25.60 percent.
Alumina	Al_2O_3	=	5.25 "
Iron oxide	Fe_2O_3	=	4.94 "
Lime	CaO	=	1.07 "
Magnesia	MgO	=	.80 "

(6) Analysis of cheap, "green sand" facing:

Moisture	=	.45 percent.
Volatile matter	=	5.75 "
Fixed carbon	=	41.49 "
Sulphur	=	.62 "
Ash	=	51.69 "
Specific gravity	=	2.489

The following is an analysis of the ash:

Silica	SiO	=	32.13 percent.
Alumina	Al O	=	2.77 "
Iron Oxide	Fe O	=	6.78 "
Lime	CaO	=	1.69 "
Magnesia	MgO	=	8.32 "

This sample was said to contain 25 percent of soapstone.

Now, if we conclude the maximum amount of magnesia in a natural graphite to be 1 percent and use the factor 3.144 we would obtain 22.17 percent of soapstone as an adulteration. (Thus: Subtracting 1.00 percent from 8.32 and multiplying the magnesia by 3.144 we get the above result.)

If, however, we conclude that there is no magnesia in the ash of a graphite and use the old factor of 3 then we obtain 24.96 percent.

The price of the "commercially pure" graphite (analysis — 4) was given as 8½ cents per pound; that of the "Stove Plate" facing as 6 cents, and of the "cheap" as 3½ cents.

The following analysis of coke dust, anthracite, common soft coal and charcoal are given for comparison, also analyses of soapstone:

(7) Analysis of coke dust:

Moisture	= .19	percent.
Volatile matter	= 1.40	"
Fixed carbon	= 86.89	"
Sulphur	= .98	"
Ash	= 10.54	"
Specific gravity	= 1.886	

(8) Analysis of anthracite coal dust:

	Selected Lump	Screenings.
Moisture	= .05 percent.	3.50 percent.
Volatile matter	= 4.40 "	8.99 "
Fixed carbon	=92.00 "	68.70 "
Sulphur	= .57 "	.86 "
Ash	= 2.98 "	17.95 "
Specific gravity	= 1.565	1.590

(9) Analysis of steam coal (soft coal):

	Selected Lump.	Screenings.
Moisture	= 1.39 percent.	4.44 percent.
Volatile matter	=33.82 "	32.79 "
Fixed carbon	=58.68 "	37.61 "
Sulphur	= .96 "	3.10 "
Ash	= 5.15 "	22.06 "
Specific gravity	= 1.321	1.486

(10) Analysis of wood charcoal:

	Common Variety.	Medicinal.
Moisture	= 3.83 percent.	3.66 percent.
Volatile matter	=26.57 "	33.15 "
Fixed carbon	=66.63 "	58.52 "
Sulphur	=none "	none "
Ash	= 2.97 "	4.67 "
Specific gravity	= 1.362	1.412

(11) Analysis of Soapstone and Talc:

		Vermont Soapstone. French Steatite or Talc.	
Silica	SiO_2 = 51.20	percent.	61.85 percent.
Alumina	Al_2O_3 = 5.22	"	2.61 "
Iron Ox.	FeO = 8.45	"	.25 "
Lime	CaO = 1.17	"	trace "
Magnesia	MgO = 26.79	"	34.52 "
Water	H_2O = 7.17	"	.77 "

It will be noticed that there is a material difference in the amount of "volatile matter" in the different carbon compounds; pure graphite being very low in this respect, while soft coal and charcoal are extremely high.

It would appear from this that the determination of volatile matter was conclusive proof of the presence of coal, and would be if soft coal were used as an adulterant, but hard coal and coke having a low volatile matter content might be mistaken for a natural graphite high in ash, containing a similar amount of combined water.

A chemist reporting the presence of coal in a graphite facing, by deduction of volatile matter, might be in error, and the chances are that an injustice would be done the facing manufacturer.

Samples No. 5 and 6 were reported by a young chemist as containing no graphite, a postitive statement being made that the carbon present was hard coal or coke dust.

The "supply house" objected to such decision and proved that No. 5 was natural graphite free from adulteration, and that No. 6 was the "mine run" of natural graphite mixed with 20 to 25 percent of soapstone, consequently the amount of volatile matter is not a reliable method for the presence of anthracite coal or coke dust.

Coke dust (free from oil, etc.) sprinkled on the surface of water will gradually sink, a distinction from graphite, soft and hard coal, which floats.

Difference in volatile matter differentiates coke from charcoal, and the following method devised by the author furnishes a distinctive test for the presence of anthracite coal in graphite.

Treat 0.5 gram of the sample with 50 c.c. of strong nitric acid, boiling for about ten minutes, then add 0.5 gram of pulverized potassium chlorate and boil until most of the chlorine is off.

Dilute with 30 c.c. of cold water and filter, reserving the filtrate for examination.

The filtrate from pure graphite treated in this manner should be clear and colorless, unless iron be present, in which case it may be somewhat yellow in color.

The filtrate from any kind of coal and charcoal will have a distinct amber-brown color, the soft coals giving a deeper color than the hard coals or charcoal.

To confirm the test, add 30 c.c. of stannous chloride solution and note the change in color.

The graphite filtrate will be reduced to a colorless liquid if iron be present or remain unchanged if free from iron; whereas the filtrate from coal having an amber color will be much deeper in color and in some cases nearly black.

The only precaution to be observed in this test is sufficient boiling to remove all of the hydrocarbon coloring matter in the coal.

A quantitative method giving approximate results close enough for practical purposes may be made by running a standard sample of anthracite dust along with the sample of facing and comparing the color in similar manner as to that of colormetric carbon in steel analysis.

Usually 0.2 gram of anthracite dust (previously passed through a 100 mesh sieve) is treated with 50 c.c. of nitric acid, the potassium

chlorate added and both solutions boiled for the same length of time (20 to 30 min.) then diluted with 30 c.c. of water and filtered.

The "standard" is then made up to 200 c.c. or other suitable measure for comparison with the "sample."

In regard to soapstone it may be said that the determination of magnesia is the only method to be relied upon for detecting the addition of this substance.

Soapstone used alone as a facing is objectionable on account of imparting to the face of the castings a chalk-white color, giv- them the appearance of being whitewashed.

Mixed with graphite or anthracite dust it answers very nicely for certain classes of work, especially hollow ware and similar thin castings.

Facing made entirely of anthracite dust or mixed with low grade natural graphite is termed "Mineral Facing" and is generally represented by one or more of the letters X to designate the fineness.

Such facings answer fairly well for general foundry work where a particularly smooth surface is not required, and is merely dusted on the mold to save the labor of cleaning the casting.

Car wheels and work of similar nature which have to be annealed are usually treated with mineral facing.

In concluding the remarks on "facings" it may be said that each particular kind of facing has its proper place; thus, sea coal is meant to be mixed with the sand in proper proportions, bearing in mind that too much sea coal causes cold shuts, streaked iron, etc., and that not enough used will cause the sand to adhere to the mold.

Gas coal, if not too high in volatile matter, makes the best facing for this purpose.

For work that has to be "slicked" and where a fine finish is desired, the best graphite facing should be used.

All facings should be kept in a dry place as they readily absorb moisture.

Parting Material.

The material generally used for parting purposes is "parting sand," "mill dust," charcoal and lycopodium.

Parting sand needs no description, as it is an ordinary sharp sand, fine in texture and high in silica.

The sand is sprinkled or shaken over the face of the mold, a certain amount adhering to the surface of the mold while the excess is blown off.

An analysis of parting sand is of little use, as the molder knows more about it than any chemist or outsider.

"Mill Dust" is sometimes used in place of parting sand and the novel feature introduced in a certain malleable iron foundry noted for smooth finished castings designed for harness trimmings, etc., is worthy of note.

A pail of "mill dust" i. e. dust from the tumbling barrels, is mixed with a little crude oil (fuel oil) and set afire.

The fire burns out the oil and leaves a fine coating of carbon on the sand, giving it the appearance of plumbago.

Mill dust treated in this way makes an excellent parting material and is well adapted to the "shake bag."

Charcoal is another substance used for parting and is very satisfactory, but not used so extensively of late as in former times.

The two analyses, No. 10 give sufficient data to enable one to judge of its composition in comparison with coal, coke, etc.

Charcoal may be made from nearly any kind of wood by burning without access to the air; charcoal for medicinal purposes is generally made from willow or birch; charcoal for smelting purposes is made from oak, hemlock, pine, ash or other wood growing in the vicinity of the mines.

Certain kinds of wood produce a soft, porous grade of charcoal, while others give a firm, hard product; as a rule the firm or dense kinds of wood produce the hardest charcoal.

The temperature and time consumed in carbonizing are important features; a low temperature continued for an extended time will produce a better grade of charcoal than a high temperature of short duration.

Charcoal may be made at a temperature ranging from 500° to 2,700° Fahr. but the ordinary heat is between 480° and 810° Fahr.

The density of charcoal obtained between the temperatures 302° and 518° Fahr. decreases in gravity from 1.507 to 1.402.

On the contrary, that which is afforded between 518° and 662° F. increases from 1.402 to 1.500.

The most inflammable charcoals take fire at about 580° F. while those made at a high carbonizing temperature inflame at 680 to 800° F.

Charcoal is a great absorbent of gases and moisture, taking up many times its own volume of gas, and absorbing from 0.80 to 16.00

percent of water; beech absorbing the least moisture and black poplar the most.

Lycopodium is a light yellow colored powder used as a parting material for particular work in which it is desired to make a perfect separation of the two parts of the mold, especially in intricate or deep recessed patterns.

This peculiar powder is the fine dust obtained from the plant capsules, *lycopodium clavatum*, commonly known as "club-moss."

It resists the action of water to such an extent that if the surface of a pail of water be sprinkled with the dust, the hand may be plunged into the liquid without wetting.

Owing to the high price of the powder it is often adulterated with one or more of the following substances:—the pollen of pine or fir, starch, dextrine, pulverized wax and soapstone.

The presence of pine or fir pollen may be detected by the microscope, the pine pollen being radically different in size and shape to that of the lycopodium sporules.

Lycopodium burns quickly when thrown into a flame, and on ignition leaves 4 percent of ash, the ash containing about 1 percent of phosphoric acid, the remainder being alumina, etc.

Any residue or ash in excess of 4 percent points to the presence of soapstone or other infusible matter and the determination of magnesia gives the amount of such adulteration.

Starch and dextrine are determined as follows:—moisten about half a gram of the powder with 5 c.c. of alcohol, add about 30 c.c. of water and boil for two or three minutes, then pour into a large beaker of cold water (about 500 c.c.), stir with a glass rod and when mixed, add about twenty drops of iodine solution (i. e. the iodine used for sulphur tritration is the proper strength).

Starch gives a clear blue solution, dextrine a purple color, while lycopodium produces no color or at least only a faint yellow, due to the iodine.

Concluding Remarks.

Having explained the different methods for the detection of the different carbon compounds and adulterants used in foundry facings and parting material, it follows that:—the difference in volatile matter found by means of a proximate analysis distinguishes between hard and soft coal; the sulphur by absence points to charcoal or pure graphite; the water test detects coke dust, and the nitric acid test establishes the difference between graphite and all other carbons belonging to the coal family.

In making a proximate analysis and in determination of sulphur, the same method should be used for all classes of material, consequently the "Eschka Method" for sulphur is to be preferred as it answers nicely for other material than coal.

Moisture is best determined on one gram of substance dried at 220° F. for an hour, cooled in a dessicator and weighed between clamped watch glasses.

For the determination of volatile matter and fixed carbon, Prof. Henrich's method is used, wherein the covered crucible containing one gram of substance is ignited over a Bunsen burner (Detroit pattern), for three and a half minutes, then over the blast lamp for three and a half minutes; the loss sustained representing the volatile matter.

The crucible cover is now removed and the crucible placed over a Bunsen burner and allowed to remain until the carbon is entirely consumed and nothing remains but ash.

When cool, the crucible and covers are again weighed and the difference between this weight and the previous weight after determination of volatile matter, is taken to represent fixed carbon.

The volatile matter added to fixed carbon and the result substracted from the original weight of the substance gives ash.

The following example will clearly illustrate the method, moisture and sulphur being determined on separate one gram samples.

Proximate Analysis of Soft Coal.

Weight of crucible and cover	= 24.2490	grams
Coal added	= 1.	"
	25.2490	
After 3½ min. over burner and 3½ min. over blast lamp	= 24.8708	"
Volatile matter (Loss)	= .3782	"
Weight after determination of Volatile Matter	= 24.8708	"
Weight after burning to ash	= 24.3137	"
Fixed Carbon (Loss)	= .5571	"

Volatile Matter .3782 plus .5571 = .9353 gram

.9353 subtracted from original weight of substance — 1. gram = .0647 gram of ash.

Multiplying by 100. for percent, we have the following:

Volatile Matter	= 37.82	percent
Fixed Carbon	= 55.71	" "
Ash	= 6.47	" "

The hygroscopic water (moisture) determined on a separate gram sample was .0053 gram, therefore this must be subtracted from the volatile matter if the moisture is to be represented in the analysis.

Sulphur determined on a separate one gram sample was found to be 0.80 percent, and may be stated as a separate quantity or included in the analysis by subtracting half from the volatile matter and half from fixed carbon.

In the first event, with sulphur as a separate quantity, the analysis would be stated as follows:

Moisture	= .53	percent
Volatile Matter	= 37.29	" "
Fixed Carbon	= 55.71	" "
Ash	= 6.47	" "
	100.	

Sulphur = 0.80 percent.

With sulphur interpolated in the analysis the statement would be:

Moisture	= .53	percent
Volatile Matter	= 36.89	" "
Fixed Carbon	= 55.31	" "
Sulphur	= .80	" "
Ash	= 6.47	" "
	100.	

CRUCIBLE STEEL.

I notice the inquiry in a recent edition of *The Foundry* for a crucible steel mixture for general jobbing work, and thought that a few words, coming from one who has had charge of the melting department of a crucible steel plant, would not be amiss. Especially as I realize how difficult it is to obtain mixtures actually used.

As your Mr. Nau said, crucible steel is simply the remelting of scrap with the addition of some material to harden and strengthen it—in "common" tool steel charcoal or washed metal (almost pure iron and carbon). But in the finer grades, muck iron (American and Swedish) is used, and alloys to give the desired quality.

The following mixtures were used for ordinary tool steel—carbon running from .75 to 1.10 percent.

No. 1 Bessemer steel scrap.....	30 pounds
Crucible file scrap.....	30 "
Miss. steel scrap.....	40 "
	100 "

Charcoal, 4 oz.

No. 2 muck iron (American)....	20 pounds
Boiler punchings	35 "
Miss. steel scrap	45 "

Charcoal, 10-14 ozs.
70 percent ferro-chromium, 2 oz.

No. 3 boiler punchings.....	10 pounds
Saw Gummings	15 "
Washed Metal	10 "
Tool scrap	15 "
Muck iron (American).....	50 "

Charcoal, 6 to 8 ozs.
Ferro-chromium, 1 oz.
Ferro-manganese, 2 oz.

Thus one will see in the ordinary steel many kinds of scrap may be used. For each ounce of charcoal used the increase in carbon is calculated at .04 percent—the number of ounces used varying according to the crucible used; for a new graphite crucible will add about .1 percent carbon—hence less charcoal needed. Unless otherwise stated all "medicine" (charcoal, etc.) is charged with the mixture—100 pounds to a crucible.

But I am taking too much space—will give a few more mixtures without comment:

For a good die steel.

Muck iron (American)	80 pounds
Saw Gummings	20 "
Charcoal	20 ounces
70 percent ferro-chromium.....	3 "
80 percent ferro-manganese.....	5 "
Metallic tungsten	3 "

Special Tool Steel.

Muck (Swedish)	65 pounds
Fine tool scrap	35 "
Charcoal	20 ounces
Manganese oxide	12 "
70 percent ferro-chromium.....	5 "
Ferro-tungsten (80 percent)	4 "

Lastly will give a mixture used for high-speed steel, an excellent grade:

Muck iron (Swedish)	45 pounds
"Special" tool scrap.....	40 "
Washed metal	10 "
Ferro-chromium	5 "
Ferro-silicon	1½ "
Clay	4 "

When melted crucible is "pulled," slag fluxed off, and

Ferro-manganese	6 ounces
98 percent metallic tungsten.....	18 pounds
Flux	1½ "

added. The crucible is then placed back in furnace for about thirty minutes.

Hoping the above may be of some use to your readers, I remain,

Very truly yours,

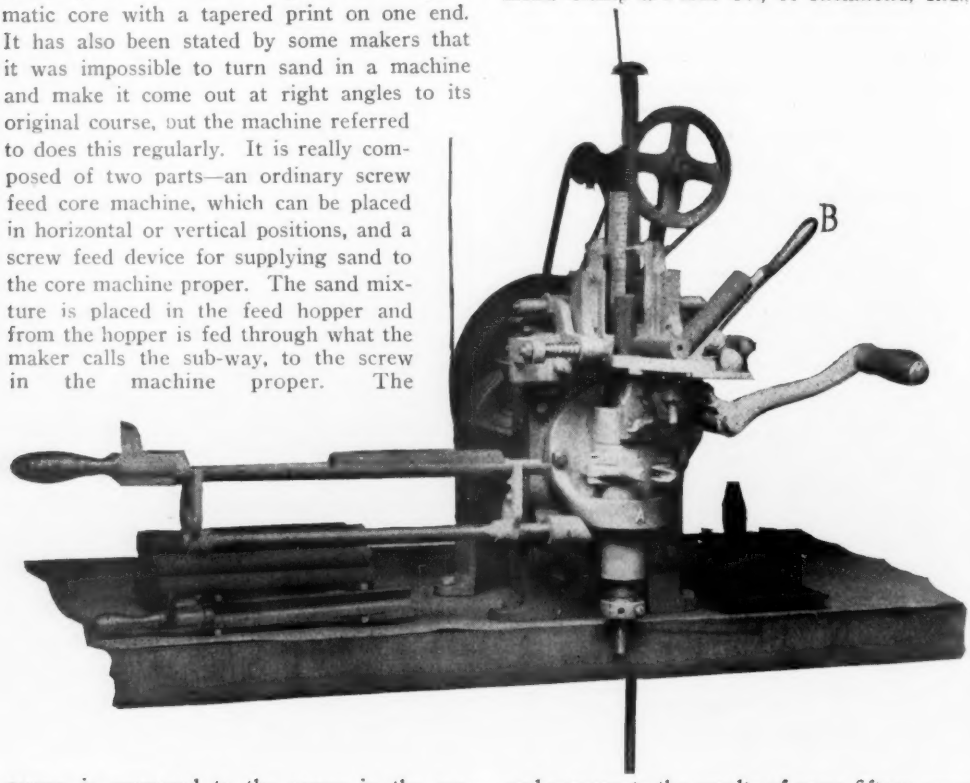
ROBT. R. BARRINGER.

THE DIAMOND UNIVERSAL CORE MACHINE.

This machine, like many other inventions in other lines, has come forward with some features which break up pet theories. In other words, it does what the core machine men have been telling us could not be done. That is, it makes a short cylindrical or prismatic core with a tapered print on one end. It has also been stated by some makers that it was impossible to turn sand in a machine and make it come out at right angles to its original course, but the machine referred to does this regularly. It is really composed of two parts—an ordinary screw feed core machine, which can be placed in horizontal or vertical positions, and a screw feed device for supplying sand to the core machine proper. The sand mixture is placed in the feed hopper and from the hopper is fed through what the maker calls the sub-way, to the screw in the machine proper. The power is conveyed to the screw in the machine by means of a compound bevel and spur wheel, so that the head can be turned in any direction and may deliver its core horizontally, at any angle or vertically. When set in a horizontal position the machine makes ordinary stock cores. When set in a vertical position the core is turned up to the proper height, as indicated by a rule or scale. A pair of dies are closed about the core in such a manner as to form the print upon it, and the lifter is then placed under the dies to receive the cores as the dies recede.

The lifter for handling the long stock cores is also of an interesting construction, and is shown in the cut. It is composed of two pieces. The pieces are hinged at one end so that they may be separated and the core rolled out on a plate without injury. By means of this green cores can be lifted and transferred from one plate to another or can be piled up in a pyramid without breaking them. The machine can be operated either by hand or by power.

This machine is manufactured by the Diamond Clamp & Flask Co., of Richmond, Ind., and represents the results of some fifteen years of experimental work on the part of Mr. Wm. N. Gartside, proprietor.



ROCK CRUSHER JAWS.

Rock crusher jaws have always been difficult castings from which to produce satisfactory results. They are subjected to enormous strain, and it is no wonder that they break occasionally. One of the main causes of the breaking of these jaws is on account of the fact that the back faces are not more of a perfect fit, the bolts wear loose, some of the stone wears in where the surface is irregular, or the already irregular surfaces cause the castings to bear in points only and, hence, the plate breaks. Sometimes the loose pieces of rock behind the jaw wear it out at the center until the jaw is supported only at the top and

bottom and then it is broken very easily. For instance, in the case of an ordinary jaw with a chilled face with about one inch of a depth of chill, while the rest of the jaw is two and a half inches thick. In making these jaws the iron is poured hot and the chilled faces cool at once, consequently the gray iron back shrinks and places the parts under great strain. The result is imperceptible cracks, which are formed during cooling and which later cause the jaw to break. At times the jaws do not break, but wear away rapidly and unevenly. Sometimes this rapid wear seems to be on account of the fact that some of the chilled iron chips off the face. Recognizing these various difficulties, Mr. G. H. Hawkins Emett, of New Westminster, B. C., has been experimenting to obtain an alloy or metal suitable for these jaws and has finally brought out what he calls "Hardite," which he claims can be made in any foundry and will produce jaws very much superior to those produced in the ordinary manner. Jaws of this class have been extensively tested in the British Columbia mining district, and now Mr. Emett grants manufacturing rights to foundries in other districts.

THE COPPER HANDBOOK.

"The Copper Handbook," by Horace J. Stevens, Houghton, Mich. Price. $5. Published by the author. This is the fifth edition of the book, which has now become an annual and a standard concerning all copper mines and copper industries of the world. It was originally started as a book treating of the Lake Superior copper mines; later the mines of other districts of the United States were added, and finally the work was extended to take in the entire world. There are 3,849 mines mentioned, the descriptions ranging from two lines to 12 pages each. In addition to the valuable descriptive matter concerning the producers of copper, there are chapters dealing with copper and its history, geology of copper, including native copper, sulphide copper, carbonate and oxide deposits; the chemistry of copper, metallurgy of copper and the uses of copper. These occupy something over 70 pages. There are also two glossaries—one treating of mechanical and mineralogical terms and the other of mining terms.

In case of the larger and more important producers the description of the mine includes the general economic geological conditions. For this reason the book is of especial interest to mineralogists, geologists and mining men.

PRACTICAL ALLOYING IV.

Standard Alloys.

BY JOHN F. BUCHANAN.

When standard alloys are mentioned, one naturally thinks of the metals which enter into the currency of the country,—the formulae for the gold, silver, copper and nickel coinages. The standards of the mint are based on the exchange values of the metals employed; the alloys being for the most part compounded of two metals, the less valuable being added in proportions required to cover the cost of manufacture and the wear and tear of circulation. Consequently the coinage alloys are easily adjusted. Not so the standard alloys adapted for the production of castings. The standard metals of the mint or the rolling mill are ill suited for the severer test of the melting furnace; as a rule they are too "rich" for foundry purposes. Foundrymen are well aware that it is easier to make more perfect castings from some alloys than from others; and the nearer an alloy approaches the condition of a *simple* metal the more difficult it is to procure sound castings from it. Imperfections due to occluded gases, oxides, crystallization, shrinkage, etc., must be reduced to a minimum in alloys which are intended for castings more especially when such castings are required for structural or mechanical purposes. Thus it is that dual alloys have gone out of favor in the foundry and the bulk of the modern standard brass founders' alloys are compounded of three or more metals. The monetary value of the metals used for such alloys is of no technical importance: what does matter is the purity of the metals employed. Electrically deposited metals are, therefore, preferable for alloys which have to conform to specification or to attain a given physical standard. Modern investigations have placed the distinguishing properties of some highly useful alloys on an independent platform, and we recognize them as the best in their class—standard metals giving advantages in strength, cohesion and service. Fifty years ago it would have been possible to have classified the more important casting alloys into two groups, viz., brass and bronze alloys, but now we must add at least three distinct

TABLE I.

Alloy (cast)	Composition					Tenacity	Authority
	Copper.	Zinc.	Iron.	Lead.	Phosphorus.	In tons per sq. in.	
Brass	2	1	....	....	....	12.25	Dr. Anderson.
Fine Brass	75	25	....	....	....	13.1	Mallet.
Muntz Metal	59	40	..	....	....	19.0	P. Longmuir.
Delta "	55.10	43.47	1.08	0.10	0 10	23 0	Roberts Austen.
Sterro "	55.00	42.36	1.77	Tin	0.83	27.0	Baron Rosthorn.

series which have taken root in foundry and engineering practice. I refer to the high-tension alloys, the anti-friction alloys and the "light" (chiefly aluminum) alloys of modern invention. Brass and bronze (copper-zinc and copper-tin alloys) were the forerunners of all the casting alloys, but in these days we have to distinguish between numerous kinds of "high" and "low" brass (these expressions refer to the zinc content), white and yellow brass, naval brass, malleable brass, aluminum brass, and many other kinds deriving their names from the introduction of metals foreign to ordinary brass. The same thing applies to the intricate and widely varying bronzes of the present day. The term "bronze" was formerly employed to indicate an alloy, the chief constituents of which were copper and tin—the copper being always predominant, but in recent years almost every combination of metals possessing strength and toughness may be described as bronze. Some notable examples are aluminum bronze—which does not contain tin; white navy bronze with only two percent copper, and some of Fontainemoreau's bronzes having neither copper nor tin in their composition. As it would be quite impossible to give here in detail the data relating to all the mixed metals qualified for classification as standard alloys, we shall confine our attention to those metals countenanced by engineering bodies, narrowing down the list to such alloys as are suitable for the production of castings in the foundry. Whilst cast iron and cast steel might justly be classed with other standard alloys, it would be inconsistent with the object of this article to discuss these products, considering how thoroughly they have been examined already.

Foremost amongst the useful alloys we place brass, the simplest and most reliable compound

TABLE II.

BRASS ALLOYS (FOR CASTINGS).

Name	Composition				Tested or Adopted by	Suitable for	Remarks
	Copper	Zinc	Lead	Tin			
Red brass	85 to 90	10 to 15	.....	.....	.....	Gilding alloys.	
Brazing "	80 to 90	10 to 20	.....	.....	Marine surveyors.	Flanges, Saddles.	Zinc content is regulated by thickness and temperature required.
Fine "	75 to 78	22 to 25	.....	.....	.....	Florentine bronzes.	
Dipping "	72	27	.....	1	English firms.	Ornamental castings.	Tin adds brilliancy.
Mall'ble "	70	30	.....	.....	Bolley.	Bolts, Hinges.	
Naval " I	70	29	.....	1	British Admiralty.	Stanchions, etc.	Tenacity 30,000 lbs. per sq. in.
" " II	62	37	.....	1	" "	Spindles, Pump Rods.	Farquharson's alloy.
Yellow "	67	32	.5	.5	Gas and water corporations.	Taps, Unions, etc.	Test pressure 300 lbs. sq. in.
" "	67	32	.....	1	Ry. and shipping corps.	Polished brasswork.	
" "	66	34	.....	.....	Commercial standard.	Ordinary castings.	
" "	63	37	.....	.....	" "	Second quality.	
Tumery " I	66	33	1	.....	Birmingham brass firms.	General quality.	
" " II	64	33	5	2.5	Shipbuilders.	Force Pumps, etc.	
" " III	60	42	1	.....	French standard.	Bolts, Nuts, etc.	To be remelt'd.
Muntz metal	56 to 63	44 to 37	.....	.....	Muntz's patent.	Ship fastenings.	For soft Muntz add 3% lead.
"High" brass	52	48	.....	.....	Hirons.	Lock escutcheons, etc.	English.
" " II	50	50	.....	.....	Bolley.	Panels and art cast'gs	German.
Braz'g solder	48 to 52	42 to 52	.....	.....	Commercial standard.	Slabs for pulverizing.	A little lead, tin or silver is sometimes added for specific purposes.
White brass	43	57	.....	.....	Hirons.	Art castings.	
" "	20	80	.....	.....	.....	" "	

from which castings may be made. Brass, in trade circles, is generally understood to mean an alloy of two-thirds copper and one-third zinc. But in every day foundry practice brass may and does contain other elements besides copper and zinc, and the copper content may vary from 60 percent to 88 percent of the mixture, the 60 percent standard being known as Muntz metal and the 88 percent standard being what is termed red brass. Betwixt these two limits practically all the useful casting alloys are to be found. The mechanical qualities and physical properties of the brass alloys vary greatly, and, with the exception of color, none of the characteristics produced by alloying copper and zinc may be deduced from a comparison of the properties of the respective metals. Small variations in the composition and different methods of manufacture sometimes effect great changes. For example, the difference in the tenacity of cast brass and cast delta metal is very marked, as shown in Table I.

These examples are selected because they represent a fair average for each particular alloy. Many higher and lower results have been recorded, but in every case the chemical combination of iron in a brass alloy results in increased tenacity and hardness. This is probably due to the difference in molecular construction and the greater density of properly made copper-zinc-iron alloys. Whilst brass is essentially a mixture of copper and zinc, within well-defined limits, slight additions of other metals are purposely made to facilitate mechanical and manufacturing process. Table II embraces most of the mixtures of practical importance.

Phosphorus is frequently added to brass alloys for the purpose of increasing the fluidity. The same object can generally be obtained by remelting about one-third turnings with two-thirds of the alloy, fluxing with sawdust and potash. Aluminum and manganese alloyed with brass form two series of metals now classed with high tension bronze. German silver may be reckoned as nickeliferous brass, copper, zinc and nickel being the essential components. The proportions vary, as under copper 52 to 60 parts, zinc 28 to 32 parts, nickel 8 to 20 parts.

In order to determine the best proportions for alloys containing 8, 10, 12, 16 and 20 percent respectively of nickel, Hirons made numerous experiments and finally recommended the following:

Ia. Copper 62, zinc 30, nickel 8.
Ib. Copper 60, zinc 30, nickel 10.
II. Copper 55, zinc 31, nickel 12.
III. Copper 54, zinc 30, nickel 16.
IV. Copper 52, zinc 28, nickel 20.

Very few of the German silver alloys employed for castings contain more than 20 percent of nickel, but the better classes of work are generally made by adding one-third nickel to two-thirds ordinary brass (2 and 1 alloy) and lead up to 2 percent of the total mixture. The standard metal for electrical resistances is composed of copper 4 parts, zinc 1 part, nickel 2 parts. Another alloy of this description called "manganin," contains copper 84 percent, manganese 12 percent, nickel 4 percent. The presence of impurities in these alloys diminishes their value for electrical purposes. All the German silver alloys are noted for their brilliant lustre, malleability and hardness. Krupp and other authorities are agreed that tin is injurious in this alloy, both as to color and malleability, but iron, up to 2 percent, increases the effects of these properties. In foundry practice those alloys containing about 30 percent of zinc and traces of lead and iron, produce the soundest castings.

As previously stated, the bronze alloys are much more comprehensive now than formerly. The bronzes proper (copper-tin series) comprise many metals of insuperable qualities. The wide range of properties obtainable by combining these two metals has no parallel in the metal industries. Of all the useful alloys we could least afford to dispense with this series. Standard bronze alloys contain tin in proportions, varying from 1 in 4 to 1 in 12. Three well-known grades take prominence here, viz., gun bronze, which contains copper 89 to 92 percent, tin 8 to 11 percent; bearing bronze, which contains copper 82 to 88 percent, tin 12 to 18 percent, and bell metal, which contains copper 78 to 86 percent, tin 14 to 22 percent. The preparation of these alloys is based on the idea of rendering copper stronger, harder, more sonorous and easy to cast. And just as the addition of lead is advantageous in German silver cast work, zinc or phosphorus in small quantities improves some of the bronzes. Hence many modifications and additions to the original bronze alloys, giving greater strength, resilience, homogeneity and improved frictional and anti-corrosive qualities, have been adopted in engineering practice. Some examples are given in Table III.

Aluminum Bronzes.

Aluminum forms some very valuable alloys with copper, which may take the place of ordinary bronze, phosphor bronze, or steel in certain circumstances. The amount of aluminum in the bronzes varies from 2½ to 10 percent. The 10 percent bronze is said to be a true alloy: it does not liquate, and the components remain in the same ratio, however often it may be recast. It is worth noting that the combination of aluminum with metals of higher melting temperatures—copper, iron, nickel—produces *exothermic* reaction, heat being evolved. The metals thus alloyed are more homogeneous, stronger, less liable to oxidization, more fluid and easy to cast. The 7½ percent bronze is a good metal for general foundry work, and specially suitable for ship fittings, toothed wheels and gongs. Aluminum and its alloys should be carefully separated from the ordinary brass founders' alloys, as the smallest portion in alloys containing lead and in certain combinations of tin and antimony produces segregation and increases the affinity of such alloys for oxygen to such an extent as to make it difficult to obtain sound castings. Many of the difficulties of handling aluminum in the brass foundry would disappear if attention was given to this feature, and the melting practice. All aluminum alloys should be remelted; they should be melted *speedily* and cast at the lowest temperature compatible with sharp, uniform castings. Experience has taught those accustomed to handling aluminum bronze alloys the importance of using only the best grades of copper and aluminum, and also the necessity of avoiding, as far as possible, the disturbing influences of a third element.

TABLE III.

MODERN BRONZE ALLOYS.

Name	Composition					Suitable for	Remarks
Gun Metal	Copper	Tin	Zinc	Lead	Phosphorus		Specified by British Admiralty.
"	88	10	2	—	—	Steam metal.	" "
"	87	8	5	—	—	Propellers, etc.	" "
"	88	11	1	—	—	Lighthouse frames.	French "
"	83.5	13	—	—	.5	Hydraulic pipes.	N. British Lighthouses.
"	*87.5	6.25	6.25	—	—	Bolts.	Mining Corporations.
"	85 to 95	4 to 10	—	1 to 5	—	Chemical pumps.	American Manufacturers.
"	84 to 90	6 to 10	4 to 8	2 to 4	—	Steam metal.	Marine Engineers.
"	84	12	4	—	—	Bearings.	Colonial Sugar Co., Sydney.
"	82	14	—	4	—	Mill brasses.	Penna. Ry. Company.
"	80	10	—	9 to 10	.25 to 1	Loco. "	C9. T1. = Tenacity; 19.3 tons sq. in.
"	88 to 92	8 to 12	—	—	.25 to .5	Deoxidized bronze.	

* Tensile strength 14.7 tons per sq. in.: Elongation 23 percent in 10 inches (dry sand casting).

Light Alloys.

Most of the so-called aluminum castings being put into motors and electrical machine parts are made from alloys containing copper 4 to 10 percent, or zinc 8 to 30 percent. Zinc forms a cheap and efficient hardener, and in quantities up to 15 percent, it combines to increase the rigidity and strength of aluminum. Tin as an alloy with aluminum seems to develop brittleness. Sheets composed of equal parts of the two metals roll easily when the alloy is newly made, but become as brittle as glass in a few days' time. Antimony up to three percent combines with aluminum to form some useful alloys. The addition of nickel to aluminum produces unstable alloys—an alloy containing 4 percent nickel crumbling to powder in a few hours after it is cast. Here the introduction of a third element is advantageous, tin and copper being suitable for casting alloys. Some examples used for castings are given in Table IV.

Aluminum brass is perhaps the most popular of all the aluminum alloys. It is easy to manipulate provided lead and antimony are absent, and castings of great strength and brilliancy may be obtained by simply adding zinc to aluminum bronze, or aluminum to ordinary brass. The average alloys contain copper 55 to 67, zinc 28 to 48, aluminum 1 to 3. An analysis of a propeller blade, made by a leading company, gave the following result: Copper 66.95, zinc 29.60, aluminum 1.93, iron 0.97, lead 0.48. The tenacity of this specimen was equal to 30 tons per square inch, and the elongation about 16 percent in 10 inches.

Manganese bronze is recognized to be the metal par excellence for ship propellers. Its chief characteristics are. Great transverse strength, toughness, hardness and fine casting qualities. Mr. P. M. Parsons, the inventor of this alloy, introduced a *cupro-ferro-manganese* into the ordinary brass and bronze alloys and

TABLE IV.

Aluminum	Nickel	Tin	Copper	Antimony	Tungsten	Remarks
98.04	....	0.105	0.375	1.442	0.038	"Wolframinium" Analysis by Minet.
96.0	....	0.16	0.64	2.4	0.8	"Partinium" by Dr. Richards.
97.0	1.75	0.19	0.25	0.25	0.17	"Romanium."
100	....	....	....	Zinc 1 to 20	Magnesium 1 to 10	"Magnalium" Murman's patent.
96 to 98	....	....	....	1 to 2	Phosphorus 1 to 4	Ruebel's patent. "Meteorite."
97	0.5	....	1 to 2	0.5	....	Tenacity 11 tons. sq. in. Extension 5%.
98	1	....	1	....	....	Tough.
96	3	....	1	....	....	Easily tooled.
94	2	....	4	....	..	Malleable.
87	3	10	....	....	....	Hard, strong.
84.21	....	10 23	5.51	....	0.09	Mock silver castings.
95 to 98	....	....	....	Silver 2 to 5	....	Aluminum silver.
80	....	....	5	Zinc 15	....	Rigid alloy.

obtained a wonderful increase in the desirable physical properties of the metals, in the case of bronze the tenacity showing an increase of 60 percent. An alloy, the approximate composition of which is copper 58, zinc 40, manganese 1, aluminum 1, gives, in cast ingots, a tensile strength of 36 to 38 tons per square inch, with 20 to 22 percent elongation. It is stated that a properly designed screw propeller in this metal will come much lighter and give as much as half a knot increase of speed, as compared with an iron or steel propeller, this being due to reduced scantlings, smoother surface, etc., and the evils of corrosion are entirely overcome.

Babbitt Metals.

The so-called anti-friction alloys, originally introduced by Isaac Babbitt, have grown to be quite a formidable class, indispensable to the engineer in these days of high-speeds and heavy loads. These white anti-friction metals are used almost exclusively for bearings, and they have replaced many of the hard bronze bearing alloys formerly used in machinery running at high speed or under great pressure. The introduction of new metals and alloys has wrought extensive changes and many wonderful improvements in engineering practice. The high tension bronzes already mentioned have raised the capacity and reduced the factors of safety in materials of construction: the modern demand for metals which shall be light in weight, pretty in appearance, not too expensive and easily worked into shape, has been met by manufacturers and inventors in the later combinations of aluminum, but of all the modern alloys, Babbitt metal, under whatever name it may appear, has proved to be the most useful and economical for machine parts in motion. Genuine Babbitt metal is composed of tin 86 parts, antimony 12 parts, copper 4 parts, but numerous alloys laying claim to superior qualities—producing less friction, requiring less lubrication and possessing greater durability are now on the market. Analyses of five different brands are given in Table V.

The British admiralty uses alloys in this class ranging in tin from 83 to 85 percent, antimony 7½ to 12 percent, copper 5 to 9 percent. The utility of lead in alloys for bearings is now generally recognized, and these analyses go to show that the manufacturers of anti-friction metals are not slow to take this advantage. Standard alloys, or alloys subject to tests, may only be expected to give satisfaction when the best materials have been fairly treated. This is probably the most important feature in the manufacture of anti-friction alloys. To sum up briefly the merits of the metals used

TABLE V.

	Tin	Antimony	Lead	Copper	Zinc	
I.	78.56	11.8	6.0	3.8	....	
II.	34.74	17.1	44.25	3.92	....	Arsenic: trace.
III.	64.7	....	1 0	1.8	33 35 Bismuth	
IV.	83.26	9.74	0.86	5.50	0.32	Iron: trace.
V.	1.25	20.12	78.28	Iron 0.7	0.28	

in making these alloys, lead is the ideal metal for reducing friction, antimony is the ideal hardener, zinc is the best wearing material and tin is the best medium for combining all of these qualities.

DETERMINATION OF SULPHUR IN COKE.

One thing which has always been considered essential in the determination of sulphur in coke is the use of alcohol in burning the sample, a rather slow and at times mean method. Experiments were made using artificial gas, by which the time of burning was reduced about 45 minutes, quite an item when a car is standing to be unloaded or a furnace waiting to be charged.

With alcohol the sulphur ran: 1.00%, .98% and .99%, while with the use of gas it ran: 1.03%, 1.03%, 1.04%, the sulphur gained being at most .041%.

The blank over alcohol ran .107 % S, and over gas (burnt the same length of time as the coke) .141% S. All sulphurs are now burnt over gas, the gain being balanced by the blank, and several checks have been made over alcohol, showing practically the same results.

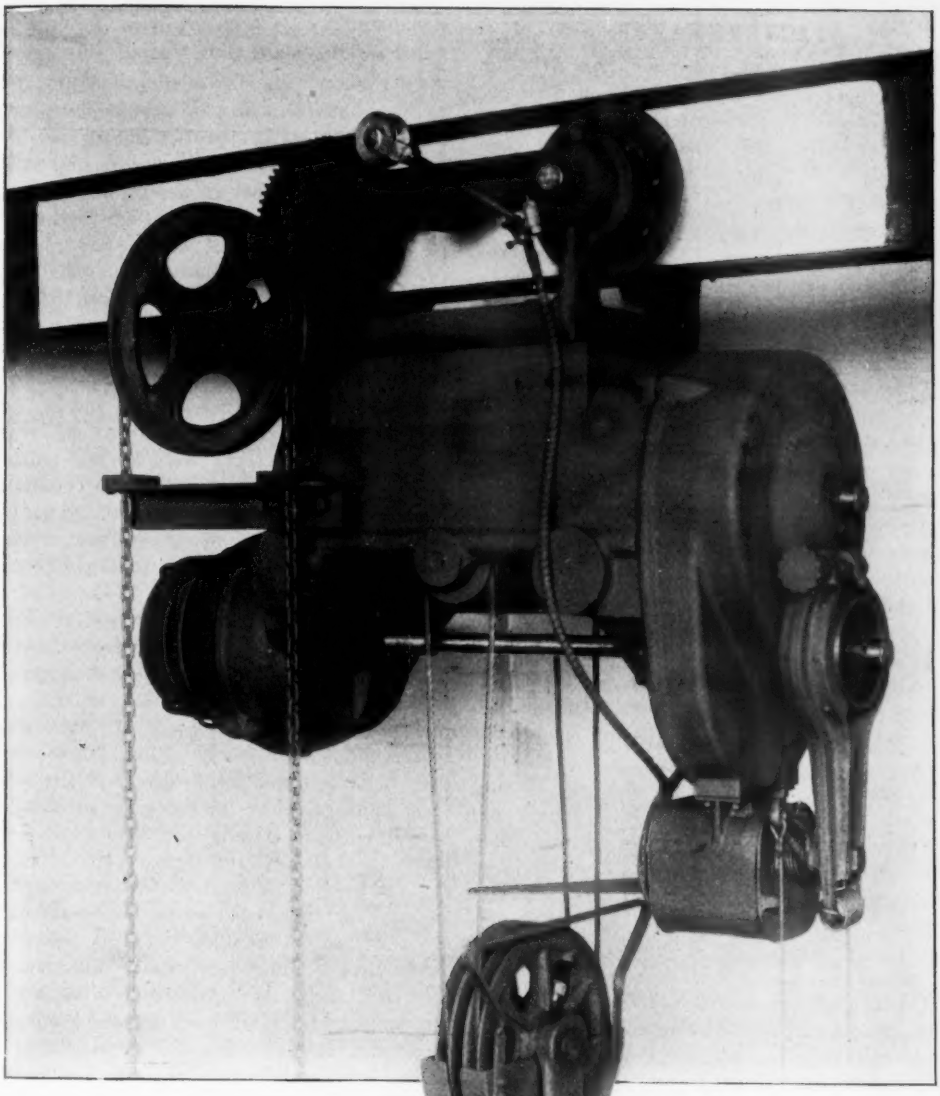
AMERICAN FLOATING EXPOSITION.

The American Floating Exposition, managed by the Export Shipping Co., with head offices at 911 Broadway, New York, is an enterprise which will be deserving of the attention of many industries. Correspondence with the company has elicited the statement that an 8,000-ton steamer will be sent around the world on a trip to consume 15 months in which a distance of 60,000 miles will be covered, the object being a display of American manufactured products which will be advantageously exhibited on the boat at ports in every country. The three upper decks of the ship providing about 20,000 sq. ft. of floor space will be available for exhibition purposes. All possible arrangements for bringing the fact of this exposition before possible foreign buyers will be made, and plans will be carried out in every port. The display will be in the hands of well-informed representatives of each exhibiting company's products. The enterprise gives every evidence of being reliably and carefully planned and is not designed as a money-making scheme. A prospectus has been issued in which the cost to exhibitors and the various items of expense are given in detail. Complete information as to the actual progress of the undertaking and just what is hoped to be accomplished may be obtained by addressing the managers. The idea seems to be an excellent one, and from an advertising standpoint a remarkably good one for a variety of industries. The co-operation of the department of Commerce and Labor has been obtained, and if a sufficient number of manufacturers see fit to take advantage of this scheme its success would seem to be assured.

A HANDY ELECTRIC HOIST.

Trolley track systems are being used more generally every year in foundry practice, and now that the electric hoist has been applied to the trolley, it is possible to use these devices for handling heavy loads with very great rapidity and ease. To work efficiently, and, at the same time, give the maximum life to the ropes and the minimum expense for repair, an electric hoist should be provided with drums and sheaves large enough to prevent injury to the rope caused by bending it around too short a radius. The diameter of the drum used of course depends upon the diameter of the rope. The sheaves should be of the same diameter as the drum, for the life of the rope is shortened just as much by bending it around the sheave as by bending it around a small drum. In fact, a rope passing around a sheave is destroyed more rapidly than it is by being received on a drum, on account of the fact that the rope receives one bend as it passes onto the drum and then lies in the position in which it is received until it is paid out once more, but when a rope passes over a sheave it is bent on both the incoming and outgoing sides. Many makers provide sheaves with a smaller diameter than the drum, which should not be the case. The electric hoist shown in the accompanying illustration shows both sheaves and drum of the same diameter, and the diameter is made equal to that specified by the rope manufacturers for the size of rope used.

The head room occupied by an electric



hoist using a single drum, cannot be less than the combined diameters of the drum and sheave and the necessary clearance distance between them, and this must always be taken into account in placing the beams on which the hoist is to run.

In the machine shown the hoisting is done by electricity, the motor being controlled by ropes reaching to the floor which are shown at the right. The hoist is made to travel along the beam by the racking chain shown at the left. The supply of electricity is taken from the trolley wire running parallel to the beam.

This hoist is made by the Sprague Electric Co., 527-531 West Thirty-fourth street, New York city.

The Hoffman Hinge & Foundry Co., of Cleveland, O., has just issued a very neat little booklet 3½ x 6¼ in., entitled, "From Blue Print to Finished Engine," in which it describes the foundry equipment and method of producing automobile castings and engine work as carried on by this company. It is very neatly printed and fully illustrated.

ANSWERS TO "THE FOUNDRYMAN'S PATTERNMAKER."

I read with some amusement the article in the October *Foundry* on "The Foundryman's Patternmaker." The writer could not surely have intended that the article be taken seriously. He indulges in a number of generalities that apply just as much to patternmaker as to the foundryman and vice versa, as for instance: his green sand core patternmaker and dry sand core patternmaker apply with equal or more force to the molder, as he has his hobbies too. Then he illustrates by two examples that must be classed among the A B C's of patternmaking and molding. Both examples would and should be governed solely by the fact of how many castings are to be produced. If only one or two, it is not wise to put too much extra cost on the pattern. If, however, they are to be made in scores or hundreds, fifteen minutes saved in the foundry is a valuable asset and should be cared for. For once, it may pay to take some risk but for standard output the safest way is, generally speaking, best and cheapest.

We had thought that the foundry foreman's life was one of trouble anyway, and we can scarcely conceive the idea that he would desire to multiply them to the extent of assuming charge and having full authority in the pattern shop, as to how patterns should be designed and constructed. If so, he must not lose sight of important details. For the sake of argument we will grant that the writer is capable of doing this. If so, he is one of about five percent of the foreman molders of today.

Let us imagine the foreman molder is in full control, all is harmonious between pattern shop and foundry, for the patternmaker is no more than an assistant like an assistant in the foundry; for example: one who is only there to carry out the ideas of the boss, and must not be too original for fear he lose his job. The firm has been long established and makes some particular line, but an intricate piece of work of a totally different class comes along, the drawing reaches the pattern shop and our friend, the foundry pattern shop foreman, on his daily round giving his orders says "Tom, Dick, or Harry," or whatever the patternmaker's name is, "you had better start that job." "Well, all right. How will we make it? It is up to you to have it the way you want it." Now how many molders of "practical experience in the foundry, I mean one who has served his apprenticeship on the floor and has learned by daily failures and successes the many small details that govern results obtained," how many of these could tell you intelligently what six of those many lines that cross each other stand for? But to quote again, "A foundry foreman should be more competent to determine what the proper method of molding a job is than the patternmaker foreman," but is he? In this case the patternmaker has no interest beyond the ideas of the molder. How soon will that job be ready for the sand?

The successful patternmaker is one that always keeps in mind how the piece he is making is going to be molded, and if more than one way suggests itself, takes that which is best and safest, as well as the quickest method of doing the job. If these conflict he will choose the safest method even if it does run him into an argument with the foreman molder, who in many cases is willing to take chances to save time.

The successful patternmaker will, if he is wise and cares for him own comfort, before he starts a pattern of any importance, consult with the foundryman, not that he may get much help—though two heads are better than one, if he can succeed in getting the foundryman to understand the job he may get some ideas, but principally for the fact that it makes harmony, saves kicking and brings good results, for it often leaves him a free course in the construction of the job and a chance after if anything turns up wrong to bring forth the fact that the foundry had been consulted.

We have in mind a certain casting made in this city, much too intricate to illustrate in the limited time and space at our command at present, that two foundry foremen at least declared impossible to make even after the patternmaker had finished his work on it and explained to them how it could be done. The way this casting was made was by the pattern shop foreman assuming responsibility and taking charge of it in the foundry. By the aid of two competent molders, who knew their business but did not presume to know the patternmaker's business better than he knew it himself, he brought the job to a highly successful result, the credit for which one of the foremen before mentioned tried to assume.

I am not a little surprised that the writer of "The Foundryman's Patternmaker" finds it so difficult to get the ear of the management, because a wide experience teaches us

that it is much easier for the foundryman to get his way than the patternmaker with the management, for the reason that his work shows direct results, either good or bad, while the patternmaker is looked on more or less as a necessary evil.

Not to take up too much of your valuable space I will conclude by saying: The patternmaker will continue to furnish the practical molder with some of the most advanced ideas in foundry practice which he, by his "peculiar instinct," may make or mar as he sees fit, or is lucky or unfortunate, as the case may be.

J. NALL.

PRACTICAL BRASS-FOUNDING FLASKS*

BY C. VICKERS, MILWAUKEE, WIS.

As a proper choice of flasks is a great aid to success in brass founding, a few words on the subject may interest the members of this association.

An excellent shape for a flask for all kinds of brass work is the one shown in the cut. It will be noticed that the pins are placed on the corners, the flask really being octagonal in shape. This arrangement makes a very neat flask and one that occupies the minimum of floor space. It is also very light, and the position of the pins greatly facilitates a clean lifting of the cope, a thing so desirable in brass molding. The sides of the flask are straight, the sand being retained by a narrow ledge on the inside of flask at the joint. My experience has been that a straight side flask with this ledge inside will hold the sand much better than a flask whose sides are beveled, as the cope of this latter flask has a tendency to sag and cannot be rammed as soft as the straight side flask. The object in placing the pins on the corners is to abolish the projecting lug, as projecting lugs are a bad feature on any brass molder's flask, because they bind very easily.

In lifting off a cope, the molder must balance it, and this is made more difficult the farther the pins are extended out from the sides of the flask. The handiest sizes for brass molders' flasks are 18 x 12 x 6 and 11 x 16 x 5½ inside measurement, that is, 18 in. long, 12 in. wide, and with a 3-in. cope and drag. The 11 x 16 x 5½ size is, I think, to be preferred for general use. Larger flasks than these are heavy and awkward to handle and unless they are barred are liable to drop out frequently, so it is more economical to have a smaller gate, with fewer patterns, and a light and easy working flask, than a larger gate, a few more patterns and a heavy clumsy flask.

Flasks for brass work are much better with four pins than three, the old-fashioned projecting lugged three-pinned flasks, are undesirable for any kind of brass work not only on account of their liability to shift but because they do not lift with the steadiness of four-pinned flasks. Indeed, a two-pinned flask is to be preferred to a three-pinned one, provided the pins are carried by the handles of the flask as in the snap.

Another point about pins is to make them with a slight taper, as if they are perfectly

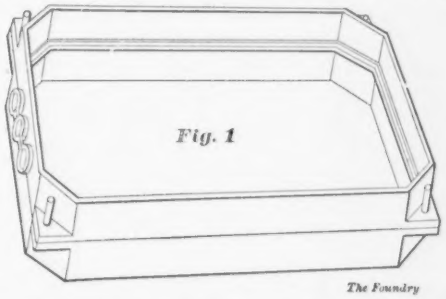


Fig. 1

The Foundry

straight and accurately fit the pin hole, they cause much trouble in securing clean lifts, because the molder cannot feel the vibration imparted to the cope by rapping on the bench, which is such an important factor in securing perfect work.

Also when the straight pin becomes rusted, as all pins are liable to, it is a difficult job to get the two halves apart and often results in broken flasks.

Pouring Off.

While it is unnecessary to equip the ordinary brass foundry with an electric crane, some sort of a system for lifting and carrying is very desirable. Though comparatively few brass foundries have any such system, they still stick to the old-fashioned man power. Generally the metal is taken from the furnaces, by the aid of an iron bar, with a man on either end, another steadying the tongs, and it takes three men to do the pouring, irrespective of the size of the pot, or the amount of metal it contains.

When the pot holds 200 lb. of metal or over, it is often a very awkward and dangerous job to take it from the fire in this manner.

All this hand work can be avoided and pouring off become a simple and easy business for

*Paper read at A. F. A. Convention, New York city, June, 1905.

one man and a boy by the installation of an overhead track, a trolley and a triplex block. You do not need a shank for pouring off as a shank needs three and often four men to use it with a tackle.

The overhead track can reach all parts of the foundry with the aid of switches and pouring can take place in half a dozen places at once if the necessary tackle is put in.

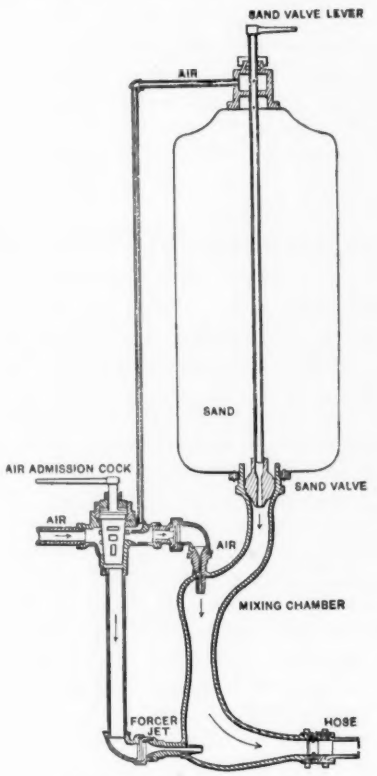
The pots are poured with the tongs, using the same tongs as with the bar, the tackle is hooked into the loop on the hinge of tongs, and a hook 18 in. in length is a handy connection between tackle and tongs.

To remove a pot from the furnace the trolley is run over it, a boy having charge of the tackle, the furnaceman or molder places the tongs on his pot, securing them with the ring as usual, then the hook on the block is lowered into the furnace and catches the loop at hinge of tongs. On the hoisting chain (a triplex block has a single chain), I had a ring large enough to slip over the handle of tongs to hold the pot from overturning. This ring must be slipped off before pouring or the crucible cannot be tipped.

The pot can be skimmed as it hangs, after leaving the furnace, so there is no lowering and hoisting, as with a shank, so the metal leaves the hearth quicker than when carried by hand. When the molder pours the boy steadies the chain, raising and lowering as required.

SAND BLAST APPARATUS.

We have received many inquiries from subscribers as to how the sand blast mechanism of a sand blast apparatus worked, that is, as to how the air got the sand into motion. The accompanying illustration shows how this is accomplished in at least one class of apparatus. The sand is introduced into the large chamber through a suitable opening in the top. The opening is then closed and the air admission cock opened. This admits air through an air pipe to the stuffing box above the sand chamber. The vertical tube which controls the sand valve is hollow and perforated above and below the stuffing box, so that air is allowed to flow in above the sand, thus equalizing the pressure in the sand box. The sand valve is opened at the proper point which admits of a flow of sand through the sand valve The opening of the air admission cock causes a jet of air to pass down through the hollow stem of the sand valve and this mixes with the sand as it falls into the upper part of the mixing chamber. A second jet of air is introduced vertically into the top of the vertical portion of the mixing chamber, as shown. This increases the velocity of the sand and mixes it still



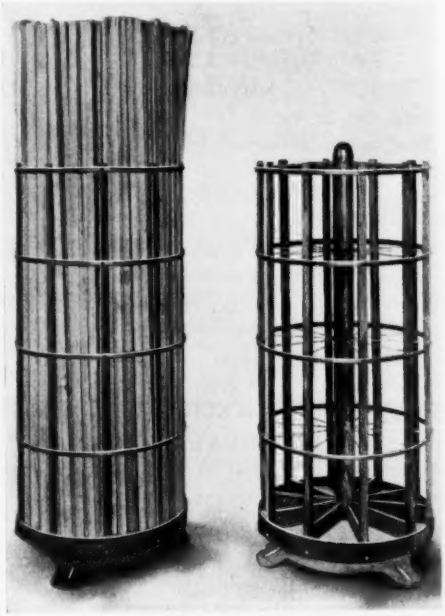
SAND BLAST APPARATUS.

more thoroughly. Finally a third horizontal jet of air is introduced at the bottom of the mixing chamber and projects the sand into the hose. The sand is conveyed to the work by a rubber hose provided with couplings which have no internal projecting shoulders which would be cut off by the sand. The apparatus illustrated is made by C. Drucklieb, 132 Reade street, New York city.

A RACK FOR PATTERN FILLETS.

All patternmakers know how easily the edges of wooden fillets are broken off or damaged, and how difficult it is to properly protect wooden fillet stock. Realizing this fact, Mr. John O. Brodin, of 1116 West Sixteenth street, Chicago, Ill., has brought out a rack for storing these fillets, as shown

in the accompanying illustration. The rack is made in one size only—17 in. in diameter and 39 in. high. The frame work is of wood and contains 10 compartments, which will hold about 3,000 ft. of different size fillets. The rack revolves about a vertical

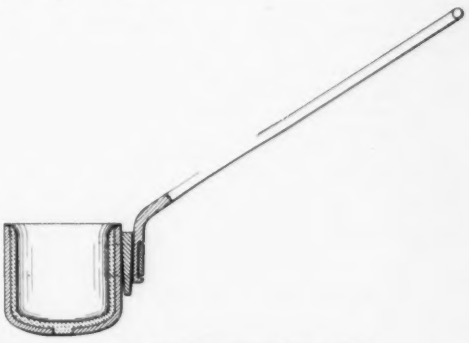


A RACK FOR PATTERN FILLETS.

cylinder in the center, the upper portion being supported on roller bearings. The base is supported on three legs, which insures its always setting firm upon the floor. The vertical spindles are held in place by bands of steel. Mr. Brodin also manufactures wooden fillets for patterns in sizes from 3-16 of an in. to 2 in.

A HANDY FOUNDRY LADLE.

Mr. McDermid, of Chicago, Ill., has recently invented and patented a very handy foundry ladle. Instead of providing each hand ladle with a fixed handle riveted to the shell, he provides a small loop on the face of each shell, as shown in the accompanying figure. The end of the ladle handle is flattened down and notched as shown. The handle is then slipped through the loop and drawn back against its inner face. An iron wedge is dropped between the ladle and the handle, thus fastening it securely. With this device the ladles can be handled much more conveniently when cleaning, lining, heating, etc., and a much smaller number of ladle handles will be required than when the old style is used.



A HANDY FOUNDRY LADLE.

TRADE PUBLICATIONS.

The Sprague Electric Co., 527-531 West 34th street, New York city, is sending out a blotter and a folder, illustrating its three motor electric crane and its combination hand geared and electric crane. The latter is intended for short spans, the crane being traversed the length of the shop by hand the hoisting being done by a special Sprague electric hoist. The folder also illustrates the company's electric hoist for use on trolley tracks.

The B. F. Sturtevant Co., Hyde Park, Mass., is sending out a small catalogue, 3 1-2 x 6 1-2 in., entitled "Mechanical Draft. What it is. What it does." In the book there is a clear concise statement as to what mechanical draft does, how it compares with chimney draft, the advantages which it has over chimney draft, and many other points. There are also many illustrations showing various installations.

The Yale & Towne Mfg. Co., of Stamford, Conn., is sending out a very neat catalogue, standard size, 6 x 9 in., describing the Yale & Towne portable electric hoists, and illustrating their use for various purposes; both for stationary service and upon overhead tracks. The catalogue contains all the information which a purchaser would require in ordering equipment for different classes of work.

The Smooth-On Mfg. Co., of Jersey City, N. J., is sending out a publication entitled "Smooth-On Elastic Cement Instruction Book," in which is described one of the products of the company which can be applied to hot iron or cold iron.

METALS IN FOUNDRY PRACTICE

Devoted to inquiries from Practical Foundrymen on subjects relating to the Melting and Using of Cast Iron, Steel, Brass and Bronze.

The following experts answer questions in this department:

W. J. Keep, Cast Iron.
J. B. Nau, Metallurgy of Steel and Steel Castings.
Dr. Richard Moldenke, Malleable Castings.
C. Vickers, Brass Castings.

We have also made arrangements with several others to act as special contributors upon Brass, Bronze and other subjects. All inquiries should be addressed to the Editor of THE FOUNDRY, and they will then be forwarded to those in charge of the different subjects.

CAST IRON NOTES.

BY W. J. KEEP.

CASTINGS NOT SMOOTH ENOUGH.

Question. We are manufacturing school desk castings, but they do not come smooth enough to suit us. Can you give us any suggestions as to how to produce smoother castings, or put us in possession of address of experts in this line who can give us this information.

Answer. The following are several suggestions. Pour your iron as dull as you can or rather save your coke and melt your iron as dull as it will run.

If your sand burns on your castings, find a silica sand as fine as your molding sand and mix in all it will stand. You of course riddle the sand that first falls on the pattern.

Increase the silicon in your iron until your castings are smooth—as the iron can then be melted with less fuel and can be poured colder and because the silicon forms graphite on the surface of the casting as it cools, which causes the burnt sand to peel off.

No doubt a little admixture of stove plate scrap would help your iron mixture and lower the cost.

A small amount of seacoal in your sand will help.

DURABLE STOVE CASTINGS.

Question. I should be pleased to learn the name of a first class book that is published on foundry work, a book that treats on the proper mixture of gray castings, these castings to be used on the tops of stoves and ranges.

Every foundryman says he can do this perfectly, and I dare say that there is about one out of 100 that knows or does it right. The castings must be smooth and as near as possible to be free from warping, sagging or cracking.

Answer. Very high silicon is the secret of success. Southern pig irons made from nearly all red ore are the best irons. Silvery irons from the same furnaces are as good as any irons for softness. Many northern irons are now about as good, and by using a softener with from 6.00 to 8.00 percent silicon and 1.00 to 1.50 percent phosphorus, a clean casting can be made.

Sand is an important matter. It must not burn into the casting.

Special facings are made to cause sand to peel from stove castings.

The silicon should never be below 2.75, and it is better above 3.00 percent. Even a 3.50 percent casting will be smoother than with less silicon, and will withstand warping, sagging and cracking better.

RELATION OF MECHANICAL TESTS TO CHEMICAL TESTS.

Question. Can you give me your version of the value of these tests.

The value of castings depends upon their physical qualities only. Smoothness—uniform close grain—softness and strength. The only way to determine the quality, is by mechanical tests. If the tests show a lack of these qualities, the chemical composition must be changed to produce the desired physical character. Physical tests must be made again to find if the change produced the expected results.

Generally the founder should know what chemical changes should be made. If not, it may be necessary to have an analysis of the casting and the irons of the mixture.

While the proportions of graphitic and of combined carbon determine most of the physical properties, and while sulphur in coke may influence this proportion and manganese may make castings hard, yet the practical way to vary graphite and combined carbon is to vary silicon, as it changes the carbon into graphite.

There are two ways of telling whether the silicon should be increased or diminished, and whether the silicon has produced the expected result.

The first is a chemical analysis or test; and the second is to measure the shrinkage, a mechanical test which gives the same information as the first.

To use a chemical determination the founder must know the percent of silicon that the desired casting should contain, and he knows that an exact percentage does not always produce expected results and must be varied next day.

To use the shrinkage test the founder must know the amount of shrinkage per foot that the desired casting must have, and if his measure shows more shrinkage than this he increases silicon, or if it is less, he decreases it.

The founder does not worry about exact percentages, but he keeps his shrinkage as near as possible to his shop standard.

So many conditions aside from chemical composition influence strength and hardness that the only way is to make actual tests.

On account of the experience and accuracy required for chemical analysis it is beyond the reach of a foundry foreman.

The mechanical analysis or shrinkage test can be used by any one without cost and in a very few moments.

The founder, however, does not realize what accuracy is.

To measure shrinkage, a yoke must be used. The chilling surfaces of the yoke must be perfectly smooth and flat. The only way to prevent rust on these surfaces is to oil before and after using and to occasionally true the surface. Yet a founder will allow the surface to become pitted and uneven and then will loose faith in the shrinkage test. Accuracy is not a part of the founder.

He will make his tests vary in size or use coarse sand—I found one foreman casting inch test bars in open sand molds and varying in size ¼ in.

Others will test a bar for strength on a machine, that is out of order and get exceptionally large results.

BRASS FOUNDRY NOTES.

BY C. VICKERS.

RED METAL.

Question.—Would thank you to kindly favor us with what in your estimation you would consider a good red metal mixture made up of the following scrap metals, viz.: scrap copper wire, scrap red brass and new lead, new zinc and new tin.

What we are especially desirous of having is a metal possessed of considerable life, as we have been having more or less trouble with spongy work and what appears to us very loose metal. No doubt you will be able to suggest something to us which will give us a closer metal and still at the same time of good cutting quality.

Would also thank you to give us a good red metal mix made up of new metals entirely, one in which casting copper and the other in which lake copper would be used.

Answer.—Use the following:

Number 1.

Scrap Copper	48 lb.
Tin	2½ lb.
Zinc	6 lb.
Lead	1½ lb.
Scrap Brass	40 lb.

The brass must be perfectly free from iron.

Number 2.

Ingot Copper	32 lb.
Tin	2 lb.
Zinc	2 lb.
Lead	2 lb.

Number 3.

Copper	44 lb.
Zinc	3 lb.
Tin	2 lb.
Lead	1 lb.

SPRINKLER FRAMES.

Inquiry: Will you please give a formula for brass that will make a smooth and hard casting, not too brittle, such as would be suitable for sprinkler frames?

Answer: For the above mixture use copper 80 lb., tin 6 lb., zinc 4 lb., lead 2 lb.

ALLOYS FOR JOURNAL BRASSES.

Inquiry: We should like to know the best composition for car brasses and whether or not old brasses can be remelted and used in a mixture. Also can journal bearings be cast in metal molds?

Answer: The best alloy for car and other journal brasses is copper 80, tin 10, lead 10. Use half scrap and half of the above new metal and you will obtain good wearing brasses. It is not advisable, however, to use old car brass scrap, unless you have made the brasses yourself and have an idea of the quality of the metal. Car brasses that are manufactured and sold at a price

no higher than must be given for ordinary red brass scrap, cannot be made of that kind of metal or their manufacture would be carried on at a loss. It is a sensible thing if a first-class bearing alloy is desired not to employ such a scrap.

The writer has never seen metal molds successfully used for casting car journals and doubts, if they were used, that there would be any economy resulting therefrom. Hand made bearings are turned out in sand molds at the rate of 140 bearings per molder per day. On machines, two laborers, one making copes and the other drags, will produce 300 bearings per day. When we consider the number of metal molds necessary to equal this output, their first cost and the expense of renewal, not to speak of the danger of pouring, we find there is nothing in the metal mold theory.

METALLURGICAL NOTES.

BY L. G. BLUNT

CALCULATION FOR FLUORSPAR SLAG.

Question.—How can one calculate the proper amount of fluorspar (CaF_2) necessary to flux the ash of the coke in a cupola as Mr. David Rogers does with limestone ($CaCO_3$) in the September issue of *The Foundry*.

Answer.—The writer will assume a coke of the same analysis that Mr. Rogers does and also that the same silicates are formed.

Analysis of coke:

Fe_2O_3	Al_2O_3	CaO	MgO	SiO_2	S
0.28	4.4	0.2	0.1	4.8	1.0

Calculation for the silica (SiO_2) fluxed by bases contained in the ash 4.8 parts contained

		Molecular Weight.	Bases.
4 Fe_2O_3	+ 3 SiO_2	= 640 : 180 :: 0.28	: x = 0.07
4 Al_2O_3	+ 3 SiO_2	= 411 : 180 :: 4.4	: x = 1.92
4 CaO	+ SiO_2	= 224 : 60 :: 0.2	: x = 0.05
4 MgO	+ SiO_2	= 160 : 60 :: 0.1	: x = 0.03
			2.07

silica minus 2.07 parts leaves 2.73 parts to be fluxed by CaF_2.

The following analysis is assumed for the fluorspar:

CaF_2	MgO	SiO_2	CO_2	Fe_2O_3	Al_2O_3
88.94	2.08	5.17	2.29	0.83	0.69

First reaction:

$2\ (CaF_2) + SiO_2 = 2\ (CaO) + SiF_4$ is the first reaction that takes place. The fluoride of silicon is volatilized and the lime (CaO) formed is left to combine with remaining silica.

Calculation for the available calcium fluoride in the fluorspar.

		Molecular Weights.	Bases.
4 MgO	+ SiO_2	= 160 : 60 :: 2.08	: x = .81
4 Al_2O_3	+ 3 SiO_2	= 411 : 180 :: 0.29	: x = .03
4 Fe_2O_3	+ 3 SiO_2	= 640 : 180 :: 0.83	: x = .23
			1.07

Hence 1.07 parts of silica is fluxed by foreign bases in the fluorspar. 5.17 — 1.07 = 4.10 SiO_2 remains in the foreign matter of the fluorspar to be fluxed.

$4\ (CaF_2) + 3\ (SiO_2) = Ca_4\ (SiO_6) + 2\ (SiF_4)$

or

$312 : 192 :: x : 4.1 = 6.66$

Hence 6.66 parts of CaF_2 is needed to flux the remaining 4.1 parts of silica in the fluorspar. 88.94 — 6.66 = 82.28, which are the available parts of calcium fluoride in one hundred parts of fluorspar. There are 2.73 parts of silica in the ash of the coke to be fluxed by the calcium fluoride, hence,

$4\ (CaF_2) + 3\ (SiO_2) = Ca_4\ (SiO_6) + 2\ (SiF_4)$

or

$312 : 192 :: x : 2.73 = 4.26$

Therefore 4.26 parts of calcium fluoride are necessary to flux 2.73 parts of silica in the coke.

Since there are 82.28 lbs. available CaF_2 in one hundred pounds of fluorspar; then 82.28 : 100 :: 4.26 : x = 5.18 lbs. or 5.18 lbs. of fluorspar are necessary to flux one hundred pounds of coke.

The amount needed to flux the sulphur and the sand on the iron, may be gone through in a similar manner.

It is very well for one to be cognizant of these reactions and calculations, but the writer does not deem it feasible to use such an elaborate scheme in practice.

CASTING ON CHILLS.

Question.—What is a good paint to use on chills in making bottle moulds and press dies? Should the metal pe poured hot?

Answer.—Carbon and linseed oil mixed 1:1; shellac with a little lamp-black mixed with it and crude oil mixed with a small amount of "old-fashioned," good plumbago are all good. The iron should be poured very hot.

MALLEABLE CAST IRON NOTES.

BY DR. RICHARD MOLDENKE.

BURNING OUT OF ELEMENTS IN MALLEABLE PRACTICE.

J. A. M. desires to know approximately what percentages of silicon, manganese, and total carbon, are eliminated in malleable heats, both in cupola and air furnace. It is not strictly correct to speak of a percentage of loss in such heats, as a given amount seems to burn out whether the silicon of the mixture is high or low. Thus in ordinary heats the air furnace burns out 0.30 silicon, whether the charge has 1.25 or 0.85. Now in the first case the percentage of loss is a little over 31 %, while in the latter a little over 21%. Hence in calculating out a mixture, it is better to add the expected loss in silicon directly to that wanted in the castings, than to figure on any percentage increase to allow for burning out.

As a matter of fact the burning out of the above elements depends upon how long the heats are in the making. If the furnace or cupola is working badly, the heats will take longer, and hence more silicon, etc. is burnt out. A new furnace, or clean cupola gives quicker results than will be the case later on. The better way is therefore to allow for this, and make the loss of silicon in the air furnace 0.35, and in the cupola 0.25. You will then be on the safe side.

Manganese goes quicker than silicon. Ordinarily malleable charges contain about 0.40 of this metal, and it is reduced to 0.08 to 0.20 in the air furnace, and about the same in the cupola. Occasionally it is nearly all burned out, but this is not desirable, on the other hand castings with high manganese also give trouble. If the charge has no more manganese than 0.40, there should be no difficulty.

Carbon acts differently in the cupola than it does in the air furnace. As malleable heats are all comparatively low in silicon in the first place, and as the malleable and the steel scrap used are comparatively low in carbon, the cupola is pretty certain to add to the total carbon every time, first because the silicon is reduced, which means greater carbon absorbing power, and second, because the fuel is in contact with the metal, and hence can give it the carbon necessary to approach the saturation point. Thus a mixture run through the cupola, originally containing say 3.25 total carbon, may come out in the ladle with 3.40. It will, of course, be understood that when this metal is afterwards annealed, the total carbon will again be reduced considerably in the outer portions of the castings.

In the air furnace, the carbon is reduced. This, however, in a small measure only. The hearth process in its general action on the metal first takes the manganese. When this is pretty well out, the silicon goes. As the silicon becomes lower, the carbon will begin to burn out also, the temperature by this time being high enough to do it. Exact figures are rather difficult to give as the reduction in the carbon is more easily effected by adding steel and malleable scrap, and hence the process has not been studied very much with the view of learning the exact conditions when pig iron alone is left to itself in furnace or cupola.

J. A. M. asks further: What percentage increase in sulphur is noticed in cupola and air furnace practice, assuming the same sulphur content in the fuel? This is difficult to answer. Suppose you run your cupola hot. You will certainly have less sulphur taken up, than if you run it cold. Normally, the increase would be about 0.02, as the low silicon irons absorb sulphur easily. In bad cases, you can absorb 0.08, all this with typical fuel.

In the case of the air furnace, the increase should not be over 0.01. Should the fuel be high in sulphur, the increase will be larger, as the flame carries the sulphur right into the bath of metal, and it is absorbed by the metal. I remember running across a fuel with over 3.00% sulphur, which caused an absorption of 0.20 on the part of the iron.

CORES WITHOUT VENTS.

The writer noticed in the September number of *The Foundry* a question concerning cores without vents for brass castings. The answer was to use a glue core. The writer uses brass molding sand, the same as

used for making the mold. The cores are black-washed to keep them from crushing. When it is not convenient to vent the cores, the brass sand heap is tempered and the cores made before any new sand is added to the sand heap. The new sand is then added; the sand cut up once more and the molds made. I have never seen the equal of these cores either for quality or cheapness. The cores are just knocked out of the castings into the sand heap, and the same sand used over to make more.

J. S. TYLER.

A SMALL MELTING RATIO.

Editor of *The Foundry:*

The writer has been a constant reader of *The Foundry* for a number of years and finds a good many interesting articles in the same. We received the October issue of *The Foundry* this morning, and in looking over the same, we noticed an article entitled "A High Melting Ratio by Accident." As this matter interests us very much we will give you a statement of our "accidents" practiced in our foundry every day of the year. The cupola we are using is a 48 in. cupola, or the same size cupola as the one mentioned in the article referred to. We generally melt in this cupola every day from 24,000 to 32,000 pounds. Our practice is a standard with us for heats running from 24,000 to 32,000 pounds. We do, as a rule, use 100 pounds of coke to each thousand pounds of metal put into the cupola, and we always have first-class results. Our heat yesterday was 29,000 pounds of iron and 2,900 pounds of coke, and we find there is about 300 or 400 pounds of good coke left over from the heat. This is an average run of our heats in our 48 in. cupola. We have melted 31,000 pounds in the same cupola with only 2,900 pounds of coke. We did this about two weeks ago. The reason for these good results is that we always make a "mistake" by putting in a large amount of coke on the bed. We, as a rule, use about 1,000 pounds of coke to the bed, and after that equal amounts, but smaller, of course, to each charge. We always have hot enough iron to pour any kind of work. Quite a lot of our work consists of small light work, some of the pieces possibly not weighing more than five or six pounds. Then again we have some that are very heavy. If anyone wishes a more detailed account of our method of charging our cupolas we will be glad to furnish same upon request.

C. T. STROTS.

ASSOCIATIONS AND SOCIETIES.

Philadelphia Foundrymen's Association.

Howard Evans, Secretary, care J. W. Paxson Co.

The 151st meeting of the Philadelphia Foundrymen's Association was held at the Manufacturers' Club on Wednesday evening, November 1, 1905, with President Devlin in the chair. There were about 36 members and visitors in attendance. The report of the treasurer showed a balance of $1,951, all bills being paid.

A. P. Briggs, secretary of the National Founders' Association, was present and delivered a short address upon the present situation among the molders in Philadelphia, which was the occasion of his visit to the city. He said that co-operation is working to one end, and that is, the end of uplifting and raising the standard of the working men. He believes that if the foundrymen of the country join with the manufacturers at present, the mechanics will receive the benefit when the question is settled.

The principal paper of the evening was prepared by Wm. H. Coleman, of Chicago, and read by Mr. A. D. Snyder. The subject of the paper was the "Effect of High and Low Blast Pressure in Cupola Practice." Following the reading of the paper there was an informal discussion, in which several of the members gave their experience on the question of the proper blast pressure required to run a cupola. The opinions differed greatly according to the existing conditions and tactics of the men in charge of the different plants. A vote of thanks was tendered to Mr. Wm. H. Coleman for the preparation of the paper and to Mr. A. D. Snyder for reading the same.

After the discussion Mr. August Williams, president of the Philadelphia Foundry Foremen's Association, gave a short talk in which he said that one of the chief objects of their association was to elevate employees. He extended a hearty invitation to the members of the Foundrymen's Association to attend the regular monthly meetings of the Foundry Foremen's Association.

Mr. Stanley G. Flagg then made a state-

ment as to the present condition of the molders' strike in Philadelphia, and called attention to the fact that it would be very difficult, indeed, to ever get the jobbing work which was being driven out of the city back to Philadelphia again.

Pittsburg Foundrymen's Association.

F. H. Zimmers, Secretary, care Union Foundry and Machine Co., West Carson Street

The entire session of the Pittsburg Foundrymen's Association, on Monday night, Nov. 6, was devoted to the subject of "Thermit," there being no regular or special business brought up. Mr. W. M. Carr, of the Goldschmidt Thermit Co., of New York, was present and gave an exceedingly interesting demonstration of thermit, including the welding of various pieces, the burning of a hole in a plate showing the intense heat of the metal and a number of other experiments designed to show the application of thermit. The room was then darkened and a series of lantern slides thrown on the screen showing a few of the many applications which have been made of thermit welding, including the welding of stern posts of vessels, welding of shafts and many other important uses. All present expressed themselves very much interested by the demonstration.

New England Foundrymen's Association

Fred F. Stockwell, Secretary, care of the Barbour-Stockwell Co., Cambridgeport, Mass.

The regular monthly meeting of the New England Foundrymen's Association was held at the Exchange Club, Boston, Wed., Nov. 8, at 5 p. m. Dinner was served at 6, after which the routine business was disposed of: President John McGee presiding. The president then introduced Mr. E. V. French, of the Associated Factory Mutual Fire Insurance Co., of Boston, who read a very interesting paper on "Fire Protection" with special reference to foundries.

Buffalo Foundrymen's Association.

John E. Gross, Secretary, 23 Builders' Exchange.

The regular monthly meeting of the Buffalo Foundrymen's Association was held on Oct. 17, President Hubbell occupying the chair. Mr. W. J. Patchell, president of the Union Iron & Foundry Co., of St. Louis, Mo., was present and gave a description of a very interesting molding machine he had invented and which is being successfully operated in his plant.

The president then introduced L. C. Dobb, consulting metallurgist, associated with the Snow Steam Pump Works, who read a paper entitled, "Metalloids of Pig Iron." The paper brought out considerable general discussion, during which many questions were asked and answered by Mr. Dobb.

Philadelphia Foundry Foremen.

W. P. Cunningham, American Bridge Co., Secretary.

The Philadelphia Foundry Foremen held their regular meeting on Nov. 13, and re-elected the following officers: Mr. A. T. William, president; J. B. Strain, vice president; Geo. M. Benkert, treasurer; W. P. Cunningham, secretary, to serve one year; and Mr. H. W. Kreamer, trustee, to serve for three years.

Erie Foundry Foremen.

W. F. Grunau, Dist. Vice Pres., care Erie City Iron Works.

There were 40 members present, and the subject of core binders was thoroughly discussed. At the close of the meeting the members partook of a light luncheon.

The regular monthly meeting of the Erie Foundry Foreman was held on Nov. 13. President Grunau first gave a talk upon the benefits to be derived from the Foundry Foremen's Club. Thomas McCallum next read a paper on "Shrinkage in Heavy Machinery Castings." He dwelt especially on how to overcome this difficulty. Great interest was shown by all present; and the winter meetings promise to be very successful.

Chicago Foundry Foremen.

Mr. Thompson, Link Belt Co., District Vice President.

The Chicago Associated Foundry Foremen held their October meeting at the Lewis Institute Thursday evening, Oct. 19. About 100 foundrymen and visitors attended. Through the kindness of Mr. Randall, one of the directors, and Mr. Hoyt, the professor of foundry practice, a number of guides were furnished to escort the visitors in parties of six through the school, first visiting the cooking department in which a large number of young ladies were studying the mysteries of scientific

cooking. (This department for some reason or other appeared to have a great attraction for the younger members of the party.) Visits were then made to the chemical laboratories, pattern shop, blacksmith department, electrical department, drafting room, testing departments, machine shops, etc., winding up in the foundry, which proved very interesting to all present. A number of very creditable specimens of the students' work were shown, also a very curious collection of "mistakes," which Mr. Hoyt prized very highly. On the whole the institute is one of the finest equipped in the state of Illinois. The entire party finally wound up in the lecture room, where an illustrated lecture on "Sand Binders" was given by Mr. Robeson, of Camden, N. J., a representatives of the American Glutrose Co.

Mr. Robeson has certainly opened up a new line of thought for all foundrymen, and it is hoped that the start made by him may be further developed until the full story of the structure of sands may be known in all localities. Mr. Robeson has shown decided good taste in avoiding any reference to the materials in which he is commercially interested during his lecture, and he was subjected to quite a quizzing match after the lecture as to the relative merits of different core materials. He answered all questions asked of him in the manner of "one who knows." This discussion ended a very enjoyable evening for all who attended.

The Chicago Foundry Foremen have arranged for a number of very interesting lectures for the coming winter and this fact has tended to largely increase the applicants for membership.

Foundrymen's Club of Missouri and Southeastern Kansas.

On Oct. 6 the foundrymen of Missouri and Southeastern Kansas met at Joplin, Mo., and formed a club to be known as The Foundrymen's Club; the members of the club to be limited to owners and managers of foundries in the mining region about Joplin. W. K. Wingert, of the Joplin Foundry, was elected president; J. W. Freeman, of the Freeman Foundry & Machine Co., vice president; I. K. Bonsil, of the Oronogo Foundry, treasurer, and W. J. Robinson, secretary.

Cincinnati Foundry Foremen.

E. W. Cadwell, Secretary.

On Saturday evening, Nov. 11, the Foundry Foremen's Club of Cincinnati entertained the Foundrymen at an informal dinner. The object of the meeting was to acquaint foundry owners with the work of the Foundry Foremen's Club, and also to interest some who have not as yet joined the club. The members and guests assembled in the lobby of the Grand Hotel and at 8 o'clock went to the banquet room on the second floor. The president of the club, Mr. J. J. Reardon, introduced the toastmaster, Mr. M. H. Holmes, who is treasurer of the local organization.

Before the regular speeches of the evening were given, dinner was served to which all did ample justice. After the dinner Mr. Holmes spoke of the history of the local organization, and Mr. Reardon gave a few words concerning its object.

To break the monotony of the program, Mr. C. E. Hall impersonated some of Ezra Kendall's sayings. He was encored twice and responded each time with suitable sketches.

The toastmaster then announced that several letters had been received from various other parties. Mr. Everetts, secretary of the national body of the Associated Foundry Foremen, had written a very interesting letter upon the association and its objects. Letters were also received from the Foundry Foremen's Associations in the following cities: Erie, Milwaukee, Indianapolis and Chicago.

After the reading of the letters, H. M. Lane, editor of *The Foundry*, was introduced, and gave a short talk on "The Evolution of Foundry Metallurgy," showing how the changes which had taken place in the manufacture of iron had affected foundry practice. He also told of the work of several of the Foundry Foremen's Clubs in the different parts of the country, and gave information concerning the work of foundry foremen's and foundrymen's organizations.

Mr. W. F. Weismann was then introduced and read a paper on the making of castings,

dealing especially with parting materials, he showed samples of a number of parting materials and showed the tests commonly applied to determine their quality.

The following members and visitors were present: Fred J. Brunner, the S. Obermayer Co.; Charles J. Goehringer, John H. McGowan Co.; H. F. Hohnstedt, G. C. Batten, J. B. Morris Foundry Co.; Wm. M. Wilson, Frederick B. Stevens Co.; John J. Bruce, West End Foundry Co.; P. F. Wehmer, Laidlaw-Dunn-Gordon Co.; James Finneran, Oberhelman Foundry Co.; Andrew Dunn Bollman, Wilson Foundry Co.; E. W. Cadwell, S. C. Tatum Co.; Fred W. Weismann, chemist; H. J. Holmes, the L. Schreiber & Sons Co.; R. Roether, Mowery Car Wheel Works; Geo. Matz, Mowery Car Wheel Works; Wm. Weber, Weber Bro. Foundry Co.; Wm. Meyers, I. & E. Greenwald; Ed. Wittkamper, V. S. P. F. Co.; Wm. A. Honeyman, United Foundry Co.; R. Huebner; W. Allen, Bullock Electric Co.; I. Hirschberg, Bullock Electric Co.; S. M. Blackburn, the John B. Morris Foundry Co.; R. McIntosh, L. D. G. Co.; D. T. Richards, Hill & Griffiths Co.; V. W. Dixon; C. E. Hall; J. Hill, the Hill & Griffith Co.; H. M. Lane, The Foundry, Cleveland; J. L. Reardon, Bullock Mfg. Co.; J. H. Ryan, Edna Smelting Co.; E. L. Binns, Bullock Electric Co.; A. Orschell, Lunkenheimer Co.; F. S. Cadwell, Black Clawson Co.; Hamilton; L. Haney, Globe Foundry Co.; Chas. Stanley, Standard Pulley Co.; John Becker, Buckeye Foundry Co.; William Fortman, J. B. Morris Foundry Co.; Alais Honnigfort, Limberg Foundry; Thos. F. McDonald, Bullock Electric Co., Norwood, O.; Nadiel Smith, John Schulte Co.; J. W. Dupey, the Wm. Resor Co.; Edw. W. Hake, the Wm. Resor Co.; John A. Schulte, John A. Schulte Co.; Frank Parker, J. A. Schulte Co.; L. Hoefinghoff, Bollman, Wilson Co.

THE ASSOCIATED FOUNDRY FOREMEN.

Frank C. Everitt, care the J. L. Mott Iron Works Trenton, N. J.

NEW YORK FOUNDRY FOREMEN'S ASSOCIATION.

C. H. Thomas, 14 Elizabeth St., So. Norwalk, Conn., District Vice President.

CLEVELAND FOUNDRY FOREMEN.

W. H. Nicholls, 608 Gordon Avenue, Secretary.

INDIANAPOLIS FOUNDRY FOREMEN.

W. S. Keller, of Hetherington & Berner Co., District Vice President.

HAMILTON, ONT., FOUNDRY FOREMEN'S ASSOCIATION.

A. Chase, care Sawyer & Massey Co., Secretary and Treasurer.

TRADE PUBLICATIONS.

The Wilcox Mfg. Co., of Aurora, Ill., has issued a 160-page catalog, 6 x 9 in., describing some of the door hangers, hardware specialties and other material which it manufactures. The catalog includes a full treatment of its overhead or trolley track carrier system, designed for carrying all classes of material. The company also makes a specialty of fire-proof door equipment, such as is especially suitable for pattern storage work.

The Niles-Bement-Pond Co., with headquarters at 111 Broadway, New York, has issued a new catalog, 9¼ x 12½ inches, describing the Niles electric traveling hoist. The catalog contains 24 pages, including a large number of illustrations, showing various applications of traveling hoists, many of which are made especially for foundry use. The catalog is very well gotten up and illustrates the subject fully.

The Chicago Pneumatic Tool Co., Chicago, Ill., has just issued a catalog 9 x 6 in., entitled "Air Cooled Duntley Electric Drills," in which there is a fully illustrated description of this class of apparatus. The catalog also contains descriptions and tables of the results of tests made at the Cleveland factory in July and August, 1905.

The Southern Brass Works, of Atlanta, Ga., are sending out an announcement which is unique in a good many ways and tells a very plain story. It first states when they will start in business, where, and then, under the head of Why, gives the following reasons.

To utilize Southern minerals in supplying a Southern demand.

To avoid excessive delays in the delivery of finished products.

To avoid excessive freight rates in the transportation of raw and finished products from and to the Southern market.

To fill a long felt want.

They then state what they will manufacture,

after which they tell us their aim is to please and their ambition to make the best goods possible, also to make a profit. If all the work of this company is carried on as well as this circular is written, it certainly should have a bright future before it.

The Brown Specialty-Machinery Co., Chicago, Ill., manufacturer of the Hammer core machine, is sending out a catalogue, 4 x 9 in., illustrating the Hammer core machines and a new core bench and cabinet which it is sending out for use in connection with the machines. Beneath the bench there is arranged a series of bins to contain stock cores. There are also provisions for the various screws, dies and core plates used upon the machine. The core machine is mounted on one end of the bench and the grinder on the other. The catalogue illustrates both the core machine and the core tapering machine or grinder. The price of the latter has recently been reduced from $15 to $12. Formerly the Hammer core machines were used only for making round cores, but the manufacturers are now supplying dies for making square, rectangular, oblong and other irregular cores.

The Michigan Stove Co., Detroit, Mich., has just published a catalogue, 5 x 8 in., entitled "The Truth About Stoves," in which a number of very interesting facts concerning heat and heating problems are given, followed by a description of the stoves manufactured by this company and illustrations showing their many convenient features.

PERSONALS.

George G. Blackwell, chairman of the Geo. G. Blackwell Sons & Co., Ltd., is now in the United States visiting the principal steel centers. He has been spending considerable time in Pittsburg, making his headquarters at Hotel Schenley. Geo. G. Blackwell Sons & Co. are independent makers of ferro-silicon, most of the other makers having formed a combine. The company makes a specialty of electro ferro-silicon containing 25 percent, 50 percent and 75 percent silicon respectively.

Mr. G. D. Quinlan, formerly of C. C. Collins Foundry, San Antonio, Tex., is now foreman of the Union Iron Works at Houston, Tex.

Geo. A. Hazelton has resigned from the Fairbanks Co., Boston, Mass., to accept a position with the Cutter, Wood & Stevens Co., Boston, Mass.

A. S. Buzzell, assistant foreman of the Reeds' Foundry Co., Worcester, Mass., has resigned to accept the foremanship of the Washburn shops, Polytechnic Institute, Worcester, Mass.

Mr. L. A. Holmes, manager of the National Steel Foundry in Fair Haven, Conn., which is a part of the plant of the National Steel & Wire Corporation, has resigned and will take a trip through the country visiting other large steel plants. The capacity of the plant has been very greatly increased under Mr. Holmes' management. Mr. A. S. Blagden will succeed to the management of the foundry.

F. S. Cadwell has accepted a position as foundry foreman for Black & Clawson, Hamilton, O.

August Bergman, of South Bend, Ind., who has been in the foundry business in that city for 26 years, has resigned his position as foundry foreman with the Bissell Chilled Plow Co., and accepted a position with the Ohio Cultivator Co., of Bellevue, O. His long foundry business should prove of value to his new employers.

O. B. Cecil has resigned his position at the Southern Pacific railroad shops at Algiers, La., to take charge of the foundry department of the Lufkin Foundry & Machine Co., at Lufkin, Texas.

Eugene Lelaurin, of Houston, Texas, was recently appointed superintendent of the foundry of the Standard Pulley Co., New Orleans.

Julius Keller, superintendent of the St. Louis foundries of the American Car & Foundry Co., has been promoted to the superintendency of all foundries of the company.

Mr. L. A. Crandall, of the Detroit Foundry & Supply Co., Detroit, Mich., who underwent a severe operation for cancer of the bowels about two months ago is rapidly recovering and is now able to be looking after some of his business.

Albert L. Terstegge, son of Henry Terstegge, of the Anchor Stove Works, New Albany, Ind., has recently invented a new device for controlling the voltage delivered to the motors on electric cars.

S. A. Watson, formerly sales agent in the

New York office of the American Steel Foundries, has been appointed manager of the Thurlow plant of the corporation.

F. A. Austin has accepted a position with the Erie Foundry Co., as manager of its machinery sales department. Mr. Austin was superintendent of the Erie Traction Co., Erie, Pa.

S. S. Knight has resigned his position as general manager of the Birmingham Pipe & Casting Co., Birmingham, Ala., to connect himself with Abendroth Bros., Port Chester, N. Y. The change was effective Nov. 1.

Delmer W. Call has left the National Malleable Castings Co. to accept the fourth vice presidency of the American Steel Foundries.

E. H. Walker, foundry contractor, has retired from the Case Co., Racine, Wis., and has been succeeded by Edward Riley, for several years foundry foreman of the Milwaukee Harvester Works.

S. S. Hoffman, of Moline, Ill., has closed out his clothing business, in which he engaged with his brother. in order to devote his entire time to the Moline Foundry Co., of which he is one of the incorporators and officers.

DEATHS.

John Rice, owner of the John Rice Foundry & Machine Works, of Stevens Point, Wis., died on Oct. 27. Mr. Rice was 68 years of age and had been suffering for several years from paralysis.

Victor M. Knecht, a pioneer iron founder of Cincinnati, and proprietor of the Phoenix Iron Works, died on Oct. 11. Mr. Knecht was born in France in 1833 and came to Cincinnati with his parents in 1845. He learned the molder's trade and later, with a number of fellow workmen, organized the Eureka Foundry Co., a co-operative concern, in 1866. A year later he withdrew from this company and purchased an interest in the Phoenix Foundry Co. He finally gained a controlling interest in the company and was connected with it at the time of his death.

Mrs. Sarah A. Moss, mother of Thos. D. West. of the Thos. D. West Foundry Co., of Sharpsville. Pa., died on Oct. 26 at her home in Cleveland, O. Mrs. Moss was a cousin of the scientist, Michael Faraday.

Cyrus I. Bewley, president and general manager of the Oregon Foundry & Machine Co., of Oregon, Ill., died on Nov. 3.

Nathaniel P. Hobart. until recently connected with the American Brake Shoe & Foundry Co., died at East Orange, N. J., Oct. 13, at the age of 58.

Joseph C. Brown, aged 65, superintendent of the Sterling Steel Foundry at Braddock, Pa., died Oct. 25 after a brief illness. He was for a time in charge of the Coxey Steel Plant, Mt. Vernon, O.

Edward L. Bartlett, head of the firm of Bartlett, Haywood & Co., founders and machinists of Baltimore, Md., died Sept. 29 after an operation for appendicitis.

FIRES.

R. Estabrook's Sons' iron foundry at Boston, Mass., suffered from fire Oct. 10. The loss including that on several adjacent buildings is $60,000, partially insured.

The American Radiator Co.'s plant at Buffalo, N. Y., sustained a loss of $3,000 by a fire in the molding department Oct. 17. The blaze was caused by sparks from one of the furnaces.

On Oct. 15 the plant of the Central Car Wheel Co., Allegheny, Pa., sustained a loss by fire of $75,000 in the foundry addition to the main building.

The foundry of Davis & Farnham, Waltham, Mass., sustained a loss of $10,000 by fire Oct. 27. The blaze started in the molding room, the greatest damage being done to patterns, stock and work in process of completion.

The Michigan Malleable Iron Co., Delray, Mich., sustained a loss of about $50,000 by fire Oct. 29. This, however, did not necessitate closing the plant.

The iron foundry of the Fred Barker Co., Paterson, N. J., was destroyed Oct. 27 by fire supposed to have originated in a defective flue in the core oven.

Wheel foundry No. 2 of the American Car & Foundry Co., Huntington, W. Va., was almost destroyed by fire Oct. 6. The adjoining buildings were not damaged.

The Lebanon, Ind. foundry and machine shops, owned by Robt. Zion, were damaged by fire to the extent of $1,000 on Oct. 11.

The plant of the Canada Brass Supply Co., of London, Ont., was gutted by fire Oct. 14. The loss is estimated at $20,000, which is covered by insurance.

The plant of the Riverside Foundry & Machine Works, Riverside, Cal., owned and operated by Theo. D. Hewitt & Co., was destroyed by fire on Oct. 5. The loss on buildings, machinery, patterns, etc., is variously estimated at from $50,000 to $60,000 with insurance amounting to $8,500.

The patterns, buildings and machinery of the Oregon Foundry Co., of Portland, Ore., were destroyed by fire on Oct. 9. The loss is estimated at $40,000, with insurance of $7,000.

The brass foundry operated by M. Kleinschmidt, 61 Noble street, Brooklyn, N. Y., was destroyed by fire Oct. 9. The loss amounted to $10,000 and is said to be covered by insurance.

The foundry department of the National Wire Corporation, Fairmount avenue, Fair Haven, Conn., was damaged by fire to the extent of $1,000 on Nov. 2.

The plant of the National Brass Works, of Reading, Pa., was damaged by fire on Oct. 31 to the extent of $1,000.

The brass foundry operated by E. C. Catlin, 403-405 Thirteen-and-one-half street, Washington, D. C., was seriously damaged by fire on Oct. 30. Both the building and the stock are fully covered by insurance.

The old Doncaster foundry, on Foundry street, Troy, N. Y., was destroyed by fire on Oct. 30. It has lately been used as a foundry by the Grant-Ferris Co., of Green Island.

The Phoenix-Porter foundry, of Syracuse, N. Y., was damaged by fire on Oct. 29 to the extent of $1,500. The fire is supposed to have originated from a hot flask or casting which the night gang left standing against a wooden partition when they went in to eat their lunch. The foundry is owned and operated by Smith & Caffrey.

NEW CONSTRUCTION.

The Standard Foundry Co., of Hartford, Conn., has taken out a buidling permit for a frame addition to its foundry.

The foundry building of the Waltham Foundry Co., of Waltham, Mass., is being enlarged.

The Standard Machine Co., Mystic, Conn., is building an addition to its foundry, which when completed will result in a greatly increased capacity.

The Schaeffer & Budenburg Co. has awarded a contract for the construction of a brass foundry at its plant in Foxboro, Mass.

A contract has been let for the construction of a brick and a frame building for the Manufacturers' Foundry Co. at Riverside Park, Waterbury, Conn. The buildings will be 22 x 51 and 40 x 51 ft., respectively, and each one story in height.

The Berlin Construction Co. has prepared plans for a new foundry for the Pratt & Whitney Co., of Hartford, Conn. The main building will be of brick and steel, 116 x 210 ft., with a wing 43 x 90 ft. and two stories high.

Landers, Frary & Clark, of New Britain, Conn., have given the American Bridge Co. a contract for the construction of the steel work of their new foundry, which was designed by architect and engineer Max J. Unkelbach.

The United Shoe Machinery Co., Beverly, Mass., is preparing for an increased output by the erection of a large new foundry.

The Chapman Valve Mfg. Co., of Indian Orchard, Mass., is adding two new buildings to its plant, one of which is an addition to the foundry and will be 150 x 250 ft.

Albert Russell & Sons Co., of Newburyport, Mass., have purchased ground adjoining their foundry and are planning to double the capacity of the same.

The Morse Chain Co., will build a large new plant at Ithaca, N. Y., which will be operated in connection with its present plant at Trumansburg, N. Y. The main building which will contain the general offices and be three stories in height, will measure 64 x 303 ft. The other buildings will all be one story in height and of the following dimensions: foundry, 68 x 135 ft.; forge shop, 36 x 86 ft.; pattern shop, 82 x 28 ft., and power house, 105 x 45 ft. Steel and concrete will be used in the construction of the entire plant.

The foundry at the new Westinghouse stoker plant at Attica, N. Y., has been completed and everything is now ready for operation.

A large addition to the plant of the Aird-Platt Foundry Co., of Watervliet, near Troy, N. Y., is being erected.

The Gleason Co., Rochester, N. Y., has work well under way on a foundry building 110 x 410 ft., of steel and concrete block

construction. Other buildings under contract will increase the cost of the plant to more than $300,000.

Abendroth Bros., Port Chester, N. Y., have completed a new foundry building, 200 ft. long and 150 wide, and are at present erecting a machine shop of similar dimensions. The new building will be fitted with electric traveling cranes and all the latest improvements.

The Swab Foundry Co., of Elizabethville, Pa., has completed the section of its new brick building to be occupied as a molding department and work on the other sections will be suspended until spring.

The Mitchell-Van Meter Co., of Linfield, Pa., is constructing a new brass foundry 40 x 120 ft. at the corner of Madison and Queen streets, Pottstown, Pa.

The Fischer Foundry & Machine Co., is installing a plant for making steel castings by the Raapke process at Ford City, Pa. The Raapke process is in successful use in Germany and France.

The Wildman Mfg. Co., of Norristown, Pa., has broken ground for a new foundry adjoining its present plant.

The plant occupied by Royer & Zweibel, of Wilkesbarre, Pa., has recently been enlarged by a one-story addition 40 x 60 ft. The addition will be used as a machine shop and the old plant as a foundry.

The American Steel Foundries is carrying on improvements in connection with its Sharon, Pa. plant, which will cost approximately $100,000.

Heebner & Sons are making an addition to their foundry at Lansdale, Pa.

The National Tube Co. is preparing to build an ingot mold foundry in connection with its Lorain, O., plant.

The Athens Foundry & Machine Co., of Athens, O., has installed two gas engines to operate its plant.

The Columbiana Pump Co., of Columbiana, O., is planning to build a new foundry 80 x 100 ft.

George Stant, of Connersville, Ind., is constructing an addition to his plant 24 x 80 ft., to be used partially as a machine shop and partially as a brass foundry. He has purchased the brass foundry business of Frank Archibald, of East Connersville, and for the present this will be operated in connection with Mr. Stant's plant.

Foster & Busler, of Wolcott, Ind., have decided to build a foundry, and work will probably be commenced during the winter.

The Jasper Machine Works, of Jasper, Ind., is putting up a building to be used as a foundry in connection with its plant.

The Bass Foundry & Machine Works, of Fort Wayne, Ind., has completed new buildings which will increase the capacity of its works from 600 to 700 car wheels per day.

A. Van Camp, of Decatur, Ind., has let a contract for a new foundry building 30 x 100 ft., to be added to his machine shop.

The Lafayette Stove Foundry, of Lafayette, Ind., is planning to erect a new building to take care of its soil pipe business.

The Northwestern Malleable Iron Works, Chicago, has secured a permit for the erection of a new office building three stories high, at 766 Park street, to cost $16,000.

The Wenzelmann Mfg. Co., of Galesburg, Ill., is rebuilding a portion of its foundry which was recently destroyed by fire. The new buildings will be constructed of brick, with a large amount of glass in the walls.

Jay Gamble has secured a contract for the construction of the buildings for the Moline Foundry Co., of Moline, Ill. The foundry building is to be 60 x 80 ft., of brick construction. The company expects to manufacture gray iron castings, doing a general jobbing business. The incorporators of the new company are: S. S. Hoffman, John R. Weeks and Peter J. Kail.

The Independent Pneumatic Tool Co., of Aurora, Ill., intends to enlarge the Aurora plant and is now purchasing new machinery to install therein. This increase is made necessary on account of its rapidly growing business.

The Rockford Well Drill Co., of Rockford, Ill., is erecting a large new foundry, pattern shop and pattern storage building, which, owing to the plot of ground upon which it is located, is of somewhat irregular shape. It is approximately 100 x 217 ft. and the portion of the building devoted to the pattern shop and pattern storage is three stories in height.

McCarthy & Malinski, of Cairo, Ill., have completed the equipment of their new machine shop and foundry and it is now running full blast.

The plant of the Janesville Machine Co.,

of Janesville, Wis., is completed and the last of the machinery is being put into running order, so that the foundry and other manufacturing departments are beginning active operations.

The new building of the Grand Rapids Foundry Co., at Grand Rapids, Wis., is rapidly approaching completion. The construction is of solid reinforced concrete and the building is the first of its kind to be erected in this section of the country.

The D. J. Murray Mfg. Co., of Wausau, Wis., is planning to build a new foundry in the spring, and is looking for plans and information as to the best equipment. They would prefer steel construction and concrete block; capacity of foundry about ten tons per day.

The Keeler Brass Co., of Grand Rapids, Mich., has broken ground for an addition to its plant 60 x 140 ft.

Mr. Husted is building an addition to his foundry at Shepherd, Mich.

The American Hoist & Derrick Co., St. Paul, is building a one-story derrick shop 40 x 185 ft., and a brass foundry and chipping room 60 x 90 ft.

Hopler Brothers, Nauright, N. J., are building a foundry for the manufacture of steam boilers.

The Maher & Flockhart Foundry, Newark, N. J., now has a capacity of 50 tons per day, which has lately been increased by building an addition to the plant.

The Somerville Iron Works, Somerville, N. J., has added another pipe foundry, increasing its capacity to 80 tons per day.

The Central Foundry Co., of Newark, N. J., is planning to begin operations at once in the construction of some additions to its plant at Lockwood street and the Morris Canal, the addition to cost about $18,000. They will consist of an addition to the foundry building 112 x 271 ft., addition to the grinding room 25 x 50 ft., and testing shop 25 x 100 ft. Also an addition to the finishing shop, 45 x 75 ft.

The Piedmont Foundry & Machine Co., will make extensive improvements to its plant at Luke, Md., concrete foundation for part of which has already been laid, though it is expected to complete the work in the spring.

Work has been started on the plant of the Louis Sachs Iron Foundry in Hamburg Place, Newark, N. J. The plans are by Architect W. Frank Bower, and call for a one-story brick building, 50 x 100 ft.

The Universal Caster & Foundry Co., of Newark, N. J., is constructing an addition to its plant 48 x 102 ft., to cost $9,000. The plans were prepared by F. H. Ogden.

At a recent meeting of the board of directors of the Taylor Iron & Steel Co., of High Bridge, N. J., it was decided to proceed with the erection of an extension to the steel foundry which will be 200 ft. long. A new pattern storage building will also be constructed.

It is announced that the Glamorgan Pipe & Foundry Co. has purchased thirty acres of water front and Belt Line property on the Norfolk, Va., harbor for the purpose of erecting a cast iron pipe plant to cost $500,000 or more. The company at present operated plants at Lynchburg and Radford Va. It is stated that it will discontinue to operate the plant at Radford, Va., July 1, 1906 and that the plant at Norfolk will take its place, though the company will continue to operate the Lynchburg plant. The company has completed the plans for its new buildings and is preparing to begin operations at once.

The Virginia Stove Mfg. Co., of Waynesboro, Va., of which Mr. R. E. Edmonds, of Pittsburg, is president and Mr. George Craig, of Waynesboro, secretary and treasurer, made its first shipment of stoves recently.

The American Cast Iron Pipe Co., of Birmingham, Ala., has broken ground for a new plant near North Birmingham, Ala., and expects to be manufacturing pipe by next May. The main foundry building will be 90 x 351 ft., and will contain four pipe pits and four ovens. There will also be a machine shop 70 x 105 ft., pattern shop 40 x 85 ft., a small casting foundry 70 x 105 ft., and other buildings for power plant, etc.

The Atlanta Utility Works, of East Point, Ga., is erecting a new foundry in connection with its plant, which will be completed within the next sixty days.

It is announced that the Red River Iron Co., of Clarksville, Tenn., has purchased land adjoining the Helen furnace property and will erect a foundry upon it.

O. M. Stull, of Buena Vista, Va., is doubling the size and capacity of his foundry.

The Cleveland Iron Works, of Shelby, N.

C., has been incorporated with a capital of $10,000, to construct and operate a machine shop and foundry.

The Stanton Foundry & Machinery Co., of Palatka, Fla., has been rushed with work and as a consequence has found it necessary to increase the size of its plant.

The Tennessee Coal, Iron & Railroad Co. is soon to begin the erection at Ensley, Ala., of mills for the manufacture of about 5,000 tons of cast iron pipe a month. The mill will be located at Open Hearth Hill, just east of the company's furnaces, the plan being to use molten metal as well as cold metal in castings.

The Ross-Meehan Foundry Co., Chattanooga, Tenn., is building two annealing ovens and a core making and storage shop 110 x 65 ft.

The push of the Riverside Foundry & Machine Co., of Riverside, Cal., is shown by the fact that after its plant was destroyed by fire on Oct. 5, before the ruins had cooled off, arrangements were made with the Miller Mfg. Co. for the use of its plant, and the following Monday, Oct. 9, the business was resumed in the new quarters. In four days the insurance was adjusted and a force of men set to work to clear up the old site preparatory to the erection of a new and thoroughly up-to-date plant.

The Cooper Wagon & Buggy Co., of Dubuque, Ia., has arranged for the construction of a foundry building.

Goodner Bros.' foundry building at Rocky Ford, Colo., which is to be used as a brass and iron foundry, is practically completed.

The Great Western Sugar Co., of Fort Collins, Colo., is preparing to establish a foundry at its Fort Collins factory which will employ about 100 men.

The Gawley Foundry & Machinery Co., of Tacoma, Wash., is making repairs and improvements on its plant, which will cost about $600.

The Dain Mfg. Co., of Ottumwa, Ia., is building a large addition to provide more room for its foundry and machine shop. This will increase the floor space of the foundry 7,480 sq. ft., and the floor space of the machine shop 3,400 sq. ft. The company is also constructing a new core room 20 x 42 ft.

The Dickson Car Wheel Co., of Houston, Tex., had one of its wheel foundries destroyed by fire recently, and immediately had a frame structure erected to take its place. This was necessary to enable the company to fill the orders on hand. It will also be necessary to run the foundry night and day for some time.

W. P. Hansen & Bro., have purchased a site at Georgetown, Wash., on which to erect a new brass foundry. They are the proprietors of the Union Brass Foundry at Seattle, Wash., located on First avenue.

The Miners Foundry & Supplies Co., recently incorporated at Carterville, Mo., will build a foundry equipped with a 10-ton cupola, crane and traveling trolley, and is in the market for machinery.

The Bonham Foundry & Wood Works, of Bonham, Tex., has been organized to manufacture the Rapid Fire hay press, and a new foundry is being built in connection with the plant, of the Rapid Fire Hay Press Co.

The company has recently been organized to construct a large foundry and manufacturing plant at Fort William, Ont. The company is to be capitalized at $100,000 and a Dominion charter is being applied for at Ottawa. Some of those interested in the company are: J. Crerar, Chicago; R. Flyn Clinch, Chicago, and Chas. O. Henderson, of New York; John A. D. Vickers, and J. M. Henderson, of Chicago, and W. J. Ross, of Fort William. The company will be known as the Northern Engineering, Construction & Supply Co.

John E. Wilson is constructing a new building 45 x 100 ft. as an extension to his foundry on Brussels street, St. John, N. B. Mr. Wilson intends, among other things, to go into the manufacture of stoves.

The Dominion Coal Co., of Glace Bay, N. S., is constructing a new foundry. The new buildings will be of brick and steel construction and will cost $25,000.

The D. Moore Co., of Hamilton, Ont., will erect a large 4-story addition to its stove foundry.

Whalen & Bowman, of the Great Lakes Dredging Co., have purchased a site on Island No. 2, at Fort William, Can., for the construction of a dry dock, marine railway, foundry and machine shop.

The Albion Iron Works, Victoria, B. C., reports that its stove foundry is exceedingly busy filling orders for local and Yukon

trade, and has called for plans for the construction of a new building.

McLean, Holt & Co., propose erecting a $10,000 stove foundry in St. John, N. B.

GENERAL INDUSTRIAL NOTES.

The firm of the Bowling Green Machine Co., consisting of John H. Fenwick and L. J. Warden, which has been conducting a foundry business in Bowling Green, Ky., for a number of years, has been dissolved. Mr. Warden has sold his interest to Mr. Fenwick and retired from the business. Mr. Fenwick will continue the business under the present firm name.

The King Stove & Range Co., Sheffield, Ala., has been incorporated with $100,000 capital and will manufacture heating stoves and steel ranges. Geo. E. King is president, Wm. H. Martin, vice president, treasurer and manager, and W. E. Newill is secretary.

The Olive Hill Light & Foundry Co., of Olive Hill, Ky., has been purchased by Messrs. E. E. Maggard and H. L. Wood. Mr. Wood will take charge of the outside work, and Mr. Maggard will superintend the shop and foundry.

The Coosa Pipe Foundry Co., Gadsden, Ala., has its new plant in operation with orders plentiful.

The Fargo Foundry Co., of Fargo, N. D., has leased the barns of the Fargo & Moorehead Street Railway Co., of the same city, and will reconstruct them to suit the company's requirements. The foundry company will manufacture gasoline engines and farm machinery, besides carrying on a general foundry business. There is also a boiler shop in connection with the plant.

The Silverton Foundry Co., of Silverton, Colo., has been incorporated with a capital of $20,000. The incorporators are M. F. Michaels, W. H. Thorp and C. T. Mead.

The Lufkin Foundry Co., Lufkin, Texas, has ordered complete machinery equipment at a cost of about $8,000.

The Penn-Wyoming smelting plant at Encampment, Wyo., has recently been enlarged by a foundry for the production of the castings necessary in connection with the smelter work.

The Long Beach Foundry & Machine Co., of Long Beach, Cal., has been incorporated with a capital stock of $25,000. The incorporators are Claude N. Waite, Albert Nelson, Charles E. Jordan, Thos. W. Cunningham and Ralph Van Hove, of Long Beach.

The new car shops of the Oakland Traction Consolidated, Oakland, Cal., are practically completed. These are located about one-third in Oakland and the other two-thirds in Emeryville. The plant consists of ten buildings, including a foundry, machine shop, blacksmith shop, etc.

Zeising & Sons Foundry Co., of Waterloo, Iowa, has purchased the McMillan building and will remove it to their premises, where it will be utilized for foundry purposes.

The Lancaster Iron & Steel Structural Works, of Lancaster, Wis., is being moved to Henryetta, I. T., where the company will engage in the manufacture of steel bridges, prison cells, etc., and will also conduct a general foundry business.

The Iowa Malleable Iron Co., Fairfield, Ia., has amended its charter, increasing the capital stock from $40,000 to $100,000.

The General Brass Works, Ltd., head office, Toronto, capital $40,000. Provisional directors Murray J. Woodbridge, Frank E. Maulson and Wm. J. Thacker.

In the September issue of *The Blast*, which is published by the Detroit Foundry Supply Co., announcement is made of the fact that Mr. W. Bruce Howard and Mr. William R. Beers have associated themselves with the Detroit Foundry Supply Co. The original company was composed of Messrs. E. J. Woodison, L. A. Crandall and W. F. Bartlett. The company is incorporated and the stock divided among those who are actively engaged in the business, so that each man feels the responsibility of the company and knows that he is working for his own interests.

The Northern Malleable Iron Co., St. Paul, Minn., has been incorporated with $200,000 capital stock. The incorporators are Kenneth Clark, Cordenio A. Severance and Charles W. G. Withee, all of St. Paul. The directors are Charles Deering, Cyrus H. McCormick, James Deering, Harold F. McCormick, John J. Glessner, William H. Jones, Richard F. Howe, Stanley McCormick and George W. Perkins.

The Western Malleable Steel Co. is pushing work on its new plant at Clark avenue and River street, Detroit, and expects to have it running within a month. About 700 skilled men will be employed. The company's specialty is castings for pneumatic tools and a closely-knit steel tube used in bicycles and automobiles.

The Adrian Steel Casting Co., Adrian, Mich., which is making a specialty of light crucible steel castings, reports business for the first three months under the new management as unusually heavy. Orders are being filled for manufacturers of automobiles, gas engines, railway supplies and other light machinery. The capacity of the plant is about four tons of steel castings a day.

The Baltimore Foundry Co., of Baltimore, Md., which was recently incorporated with a capital of $30,000, has purchased the plant at the corner of Bush and Severn streets and has it in active operation. Considerable modern equipment has been installed in connection with the foundry. Mr. A. J. Dietrich is president of the new company, Mr. Hammond Dietrich is vice president, and Mr. John W. Diven is general superintendent. About 50 men are employed.

The Veitch-Matthews Foundry & Machine Co., of Bessemer, Ala., has been incorporated with a capital of $5,000. The incorporators are George Veitch Sr., Jonathan Matthews and Geo. Matthews Jr.

The Capitol Foundry Co., of Hartford, Conn., has bought out the iron business of the Standard Foundry Co., which has been doing both iron and brass foundry work. The Standard Foundry Co. will continue its brass foundry, which will be conducted in the new buildings erected by the company. The old buildings which it leased from the Carlton Foundry Co. will be used for the iron foundry. The Capitol Foundry Co. takes over the lease of these buildings with the purchase of the iron foundry business of the Standard Foundry Co. The officers of the Capitol Foundry Co. are: president and general manager, F. W. Stickle; vice president, A. A. Tanner; secretary, William B. Judd; treasurer, Frank S. Wilmott, all of Waterbury.

Messrs. Cerridan & Haggerty, formerly with Higgins & Co., brass founders, Holyoke, Mass., have formed a partnership and started a brass foundry in Holyoke, Mass., which they call the Paper City Brass Foundry.

The New York Engineering Co., Boston, Mass., has been incorporated to carry on a general foundry business with a capital of $10,000. The officers are: President and treasurer, A. F. Bremner, 25 India Wharf; clerk, G. T. Shannon, 34 School street, both of Boston.

The Highland Foundry Co., Boston, Mass., has been incorporated to deal in stoves, ranges, etc. The capital stock is $15,000. The incorporators are: Edwin Chapman, 37 North Market street, president; Livingston Cushing, 10 Tremont street, treasurer, and H. D. McClellan, of the same address, clerk. All the officers are of Boston, Mass.

The Benedict & Burnham Mfg. Co., and the Holmes, Booth & Hayden Co., both of Waterbury, Conn., have been consolidated and will be conducted under the name of the former. The capital of the Benedict & Burnham Co. was recently increased from $400,000 to $650,000, with a view of consolidating the two firms. The consolidation has taken place to facilitate the work, as both companies are branches of the American Brass Co.

The Massachusetts Steel Casting Co., Everett, Mass., has rebuilt one of its 15-ton open hearth furnaces which it put in operation Oct. 21, and is now using its Tropenas converter in connection with the open hearth furnace for the manufacture of both light and heavy castings.

The Gibby Foundry Co. has purchased the property of the Bay City Dredging Co., Boston.

The Benedict Mfg. Co., of Randolph, N. Y., has been incorporated with a capital stock of $60,000. The company will do a general foundry business.

Practically every line is becoming specialized. One of the recent examples of this is the establishment of a firm of Advertising Engineers in New York. The company is composed of Messrs. Halbert P. Gillette and Geo. H. Gibson, and the offices are in the Park Row building, New York city. The object of the firm is to advise concerning the carrying on of introduction or advertising campaigns or to carry on such campaigns for manufacturers.

The Thomas W. Pangborn Co., of New York, announces that, owing to the rapid growth of its business, it will devote the entire building formerly used for offices and warehouse, at 42 Dey street, New York, to warehouse purposes, and establish the company's offices at 227-229 Fulton street (Glackner Building) one block north of the warehouse.

The city of New York is about to equip a modern brass foundry in connection with its fire department. The entire plant will be a complete repair shop for the Metropolis Fire Department. The S. Obermayer Co., through its New York representative, has secured the contract for the foundry equipment.

The Binghamton Brass & Bronze Foundry Co., of Binghamton, N. Y., has been organized, the address of the company being 81 to 83 Water street.

The new Racquette Foundry & Supply Co., of Potsdam, N. Y., reports that business is increasing and prospects are bright.

The Solamander Grate Bar Co., New York city, has been incorporated to manufacture grate bars and furnace castings with $2,500 capital stock. The incorporators are: Mary E. and George H. Clarke, 68 Quincy street, Brooklyn, and Harvey R. Mitchell, Jersey City Heights, N. J.

The new foundry of the Chambersburg Engineering Co., of Chambersburg, Pa., is now in operation. The first casting made was a large anvil block.

The T. B. Harkins Foundry Co., of Bristol, Pa., has lately purchased the business of the old firm of Leibrandt & McDowell Co., of Philadelphia, Pa., whose stoves are favorably known throughout the Eastern and Southern states.

The Royal Gas Stove Foundry, of Royersford, Pa., has been sold to the Buckwalter Stove Co., of the same city.

Wm. Neiman has sold his interest in the foundry company of Neiman, Smith & Co., of Hamburg, Pa., to N. A. Confer. The firm name will be changed to Confer, Smith & Co. The company expects to increase its working force during the coming year.

The Fischer Foundry & Machine Co.'s plant in South 23d street, Pittsburg, has been leased to the Jones & Laughlin Steel Company.

Samuel W. Hay's Sons, Pittsburg, have secured the contract to furnish and erect complete equipment for the model foundry at the Carnegie Technical Schools. This contract includes 7-ton Whiting cupola with structural steel charging platform, 2,000 lb. capacity, Whiting foundry elevator with Reynold's chain drive to Westinghouse motor, and No. 6 Sturtevant steel pressure blower with Morse chain drive to 15 H. P. motor.

Bondholders of the Delaware River Steel Casting Co., Chester, Pa., are expected to purchase the splendidly equipped plant of that company, which has been in the hands of receivers for some time. The court's permission for the sale of the real estate of the company has already been asked.

Davies & Thomas, Catasauqua, Pa., have been awarded the contract for the castings for the Steinway tunnel under the East river, New York. From 12,000 to 18,000 tons will be required.

The Mansfield Pattern Co., of Mansfield, O., has been incorporated with a capital of $10,000. The incorporators are R. W. Hartman, H. C. O'Brien, F. M. Reynolds, S. Glen Mason and J. H. Donaldson.

The Field Foundry and Machine Co., of Findlay, O., has been organized to carry on a general foundry and machine shop business.

C. J. Burton, for many years connected with Robert Field in the pig iron business in Cincinnati, has severed his connection with the Robert Field sales agency, and joined his father, G. F. Burton, of Springfield, O., in the organization of the G. F. Burton Co., with headquarters at Springfield. The new organization is an Ohio corporation, with an authorized capital stock of $25,000, and will continue the business of dealing in pig iron, coke, molding sand and kindred materials as formerly conducted by G. F. Burton.

Samuel Waldron, of Lebanon, Ind., has purchased from Robert Zion the machinery and tools of the Lebanon Foundry & Machine Shop which was recently put out of business by fire. He will remove the machinery to the Kersey shop on West Main street where he will establish a temporary headquarters, and in the spring will probably rebuild the foundry in a new location.

Clint Burnett and Gustav Meinshausen have established a brass foundry at Marion, Ind.

The Schock Machine Co., of South Bend, Ind., has been incorporated with a capital of $20,000. The incorporators are George W., Lura R. and Oliver Schock, and the company will carry on a general machine shop and foundry business.

For additional Industrial Notes see page 73 of the advertising.